INSTALLATION AND OPERATION

MODEL 6100
CATV SOLID STATE PROCESSOR

Scientific-Atlanta, Inc.

When ordering parts from Scientific-Atlanta, Inc., be sure to include the equipment model number, equipment serial number, and a description of the part.

MODEL NO. _____

SERIAL NO. _____

SCIENTIFIC-ATLANTA, INC.
P. O. Box 13654, Atlanta, Ga. 30324

INSTALLATION AND OPERATION

MODEL 6100
CATV SOLID STATE PROCESSOR

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IMPORTANT NOTICE

The sound trap circuitry has been improved and adjustment as outlined in paragraph 3.3.1, page 2 of this manual is no longer necessary or possible.

If the trap should become misaligned at a later date, consult the factory or your local Scientific-Atlanta representative.

INSTRUCTION MANUAL
CHANGE NOTICE

MODEL 6100 CATV SOLID-STATE PROCESSOR

To make this manual apply to your instrument, make the manual changes shown below.

Instrument Serial No.	Change
All	1

Instrument Serial No.	Change

Errata: Page 3-3/3-4, add the following paragraph:

"3.3.4 Rear Panel Test Point Connector

Figure 3.2 shows the pin locations of the rear panel test point connector."

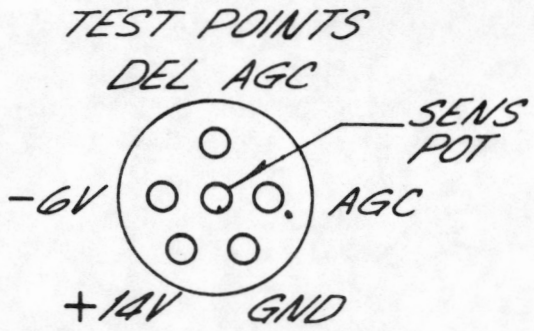

Figure 3.1 Rear Panel Test Point Connector Pin Locations

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CHAPTER 1
GENERAL INFORMATION

1.1 Introduction

This manual contains instructions for installing and operating the Scientific-Atlanta Model 6100 CATV Solid State Processor. General information pertaining to this model processor is contained in Chapter 1, installation information in Chapter 2, operating information in Chapter 3, theory of operation in Chapter 4, checkout procedures in Chapter 5, and drawings in Chapter 6.

1.2 General Description

The Model 6100 Processor is designed to receive and convert an incoming VHF television signal (channels 2 through 13) to any VHF television channel for cable distribution. The input and output channels may be selected by merely removing the input or output plugin converter and replacing with the desired channel converter. This heterodyne unit utilizes all silicon transistors for reliable, maintenance-free operation.

The instrument is comprised of a main assembly with six modular plugin sub-assemblies:

(a) Main Chassis, with power supply subassembly

(b) Input converter module

(c) Sound IF amplifier and AGC module

(d) Video IF amplifier and AGC module

(e) Substitution carrier module

(f) Output converter module

Modular construction such as this allows greatly simplified changing of either input or output channels, and simplifies failure correction to minimize down-time.

The Model 6100 is compatible with existing CATV head-end equipment.

1.3 Specifications

Minimum Input	-20 dBmV (100 μV for +60 dBmV output)
Maximum Input	+30 dBmV (31,620 μV)
Input Frequency	Any VHF tv channel, 2 - 13 MHz (54 - 88, 174 - 216 MHz)
Input Impedance	75 ohms, 1.25:1 VSWR maximum
Input Converter L.O. Stability	Crystal-controlled ±0.0025%
Noise Figure	6 dB maximum
Image Rejection	60 dB minimum
Video IF Amp Frequency	41.6 - 46.5 MHz
IF Response	Flat within ±1/4 dB
IF Video Carrier Frequency	45.75 MHz
Adjacent Video Carrier Rejection	Greater than 40 dB, 39.75 MHz
Adjacent Sound Carrier Rejection	Greater than 40 dB, 47.25 MHz
Envelope Delay	Less than 100 nanoseconds
AGC Type	Sync pulse tip reference, noise immune
AGC Sensitivity	±0.5 dB maximum output change for 40 dB input change
Sound IF Amp Frequency	41.25 MHz
Sound IF Amp Limiting Minimum	10 dB at +25 dBmV output, with 100 μV input to antenna terminals
Substitution Carrier Frequency	45.75 MHz, crystal-controlled
Substitution Carrier Output	+40 to +60 dBmV
Substitution Carrier On-time	Delayed approx. 10 seconds
Substitution Carrier Off-time	Instantaneous
Output Converter Oscillator Stability	±0.0025%, crystal-controlled

Output Converter Frequency (Mid-Band Channels Available)	Any VHF tv channel, 2 - 13 MHz (54 - 88, 174 - 216 MHz)
Maximum Output	
Sound Carrier	+45 dBmV
Video Carrier	+60 dBmV
Output Impedance	Dual 75 ohms, VSWR 1.5:1, maximum
Output Level Control	20 dB minimum
Spurious Outputs	
Below Output in any tv Channel	60 dB
Below Output at any Other Frequency	40 dB
Input Power Requirements	100 - 130 volts ac, 60 Hz, 10 watts
Power Supply	Solid-state series-regulating type
Power Supply Outputs	
+B	+14 volts, 450 mA
-B	-6 volts, 27.6 mA
Weight	16 pounds
Mounting	5-1/4H x 19W x 16D, standard rack mount spacing (rack slide optional)
Finish (Front Panel)	S-A Green Vinyl Organsol coating

CHAPTER 2
INSTALLATION

2.1 Introduction

This chapter contains information required to unpack and install the Model 6100 Solid-State Processor. Power requirements and fuse information is included also.

2.2 Unpacking

While unpacking, carefully compare bill of lading with equipment, checking for in-transit damage at the same time. Should errors be noted, notify Scientific-Atlanta and the carrier as soon as possible--but only after double-checking and sifting any packing materials.

2.3 Mounting

The instrument is designed for rack mounting, either directly into the rack or on rack-mount slides*. It should therefore be mounted in a rack permitting some access to the rear of the unit. The signal processor should be free from RF radiations emanating from nearby equipment, or from line transients capable of damaging the instrument. It is designed to operate in surroundings comfortable to humans.

2.4 Power Requirements

The Model 6100 Processor requires 100 to 130 volts ac, 60 Hz, from a power source capable of providing 10 watts. Note total current consumption of the processor and associated equipment on the same line before applying ac power. Avoid sharing a line feeding heavy motors or other large current drains. A standard three-prong cord is provided for connection to a grounded, three-prong power outlet.

2.5 Fuse

A single power fuse is located on the rear of the chassis next to the power cord. When installing the unit, insure that the fuse is in place and that it is of the proper rating--3AG 1A slow-acting.

*Optional

2.6 Emergency Alert and Alternative Program Systems

Separate sound and video IF signals are available at the input converter outputs ahead of the IF amplifiers to facilitate the installation of an emergency alert system or automatic program switchover for non-duplication of programming.

CHAPTER 3
OPERATING INSTRUCTIONS

3.1 Introduction

This chapter contains the basic operating instructions and procedures for the Model 6100 Processor.

3.2 Operating Controls

The front panel contains five operating controls. The following list and discussions indicate what they are and what they do:

POWER ON/OFF Switch	Connects and disconnects ac power supplied to the unit and plugin modules
OUTPUT LEVEL Controls	
VIDEO	Provides adjustment of the video IF amplifier gain independent of the video IF AGC loop
SOUND	Provides adjustment of the sound IF amplifier gain independent of the sound IF AGC loop
SUBSTITUTION	Provides adjustment of the substitution carrier output level
Meter	The front panel meter is used to indicate the video, sound, and substitution carrier output levels (above)
Meter Switch	Associated with the output level controls and the front panel meter is the meter function switch. If adjustment of the OUTPUT LEVEL Controls is required, the meter switch may be placed to the appropriate position to monitor the adjustment. The meter switch may be placed in the OFF position when desired
SIGNAL OFF Indicator	Indicates loss of signal

3.3 Adjustments

3.3.1 Sound Trap Adjustment

The sound trap must be adjusted before the processor is put into service. The adjustment is accomplished as follows:

(a) Turn processor OFF. Remove bottom cover of processor, or insert input converter extender (Part No. 65935), and insert input converter into extender. Connect desired signal to RF IN.

(b) Turn processor ON. Turn meter function to SOUND. Turn sound output level control fully CCW (minimum output). Turn video output level control for mid-scale reading (control of the sound level with video level control indicates maladjusted trap).

(c) Through two access holes in the side of the input converter, alternately adjust the coil and potentiometer for minimum meter level.

(d) Increase the video level as required. Note as the depth of the null increases, the meter will move with modulation.

(e) Turn the meter function switch to VIDEO. Set the video level to +55 dB. Turn the meter function switch to SOUND. Adjust sound output level control to +35 dB or less. If sound level cannot be set to +35 dB or less repeat step (c). When a sound level of +35 dB or less is obtained, sound trap adjustment is complete.

3.3.2 AGC Adjustment

The AGC adjustment should be performed as follows:

(a) Remove top cover from video IF module and reinstall module in receiver.

(b) Check B+ at test point with VTVM. If B+ is not in the range of 13.8-14.2 volts dc, adjust to +14.0 volts dc. (Note B+ voltage will drop approximately 0.2 volts when the substitution carrier comes on.)

(c) Remove the input signal. Connect VTVM to undelayed AGC test point (see Figure 3.1) and ground.

(d) Adjust A3R43 completely clockwise for minimum AGC voltage.

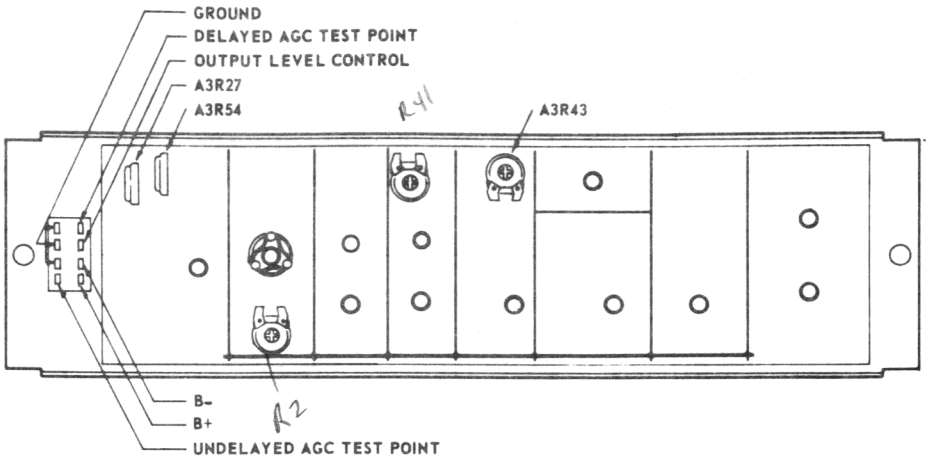


Figure 3. 1. Video IF Module

(e) Adjust A3R54 for AGC voltage of 4. 0 volts dc.

(f) Adjust A3R43 for 4. 1 volts dc (slight upward movement). This completes undelayed AGC adjustment.

(g) To adjust the delayed AGC, supply +10 dBmV (0 dBmV for Channel 6) to RF input at the picture carrier frequency. Off-air tv signal will do if it is +10 dBmV, or attenuated to +10 dBmV.

(h) Connect negative lead of VTVM to delayed AGC test point (see Figure 3. 1) and the positive lead to ground.

(i) Turn A3R27 completely clockwise to approximately −6 volts dc, then adjust A3R27 counterclockwise for delayed AGC voltage of −0. 7 volts dc. This completes delayed AGC adjustment.

3. 3. 3 Output Level Control Adjustment

The OUTPUT LEVEL Controls may be adjusted to the desired level merely by placing the meter function switch to the position corresponding to the control to be changed, then making the adjustment while watching the meter for indication of the output level.

CHAPTER 4
THEORY OF OPERATION

4.1 Introduction

This chapter contains discussions of the theory of operation of the Model 6100 Signal Processor. Frequent reference to the schematic diagrams in Chapter 6 is recommended to facilitate understanding of the circuitry.

4.2 Main Chassis and Power Supply

The main chassis (Figure 6.1), into which all modules are plugged, contains the intermodular wiring and heavier power supply components. The rectifier and other lightweight circuitry portions of the power supply are contained on plug-in board A2. The regulator is a simple series type, R1 being the reference adjustment.

4.3 Meter Circuit

After IF amplification (Par. 4.4, 4.5), the video and sound signals are recombined in toroid network L2-R8 (Figure 6.1). The combined signal is sampled at this point by the output level monitor, a built-in field-strength meter (Figure 6.2). The monitor circuit consists of a two-stage RF amplifier (Q1, Q2), peak detector (CR3), and differential amplifier (Q3, Q4).

The RF amplifier circuitry is tuned to either the video or sound portion of the combined signal by means of a front panel selector switch. Another switch position selects the substitution carrier. The selected signal is detected and the resultant dc voltage is amplified and used to drive the output level meter. In the VIDEO position, the peak detector circuit responds only to the sync-tip level, assuring accurate meter indications, unaffected by changes in picture content. Although the output level monitor actually samples the signals at IF frequencies, the meter is factory calibrated to read the actual output level of the signal processor.

4.4 Video IF Amplifier and AGC

The video IF signal enters the video IF amplifier and AGC module (Figure 6.3) through a special bandpass filter circuit with traps to give high rejection of adjacent channel picture and sound carriers, and color subcarrier.

The second and third stages of the five-stage IF amplifier are gain-controlled by an undelayed AGC voltage. Forward AGC transistor stages are used to greatly improve signal handling capabilities. The output of the fourth stage is lightly coupled into an AGC amplifier where it is amplified, then peak detected. The resulting signal is amplified in a special "noise inverter" circuit which prevents any impulse type noise from appearing at the output. This noise-free video signal is again peak detected to obtain a dc voltage proportional to the sync-tip level of the television signal. This dc voltage is amplified and used to AGC the video IF amplifier. A portion is delayed and used to AGC the input converter RF amplifier. The gain of the fifth stage may be manually set with the VIDEO OUTPUT LEVEL control on the front panel of the unit. The dynamic range of the signal processor does not depend on the setting of the VIDEO OUTPUT LEVEL control.

4.5 Sound IF Amplifier and AGC

The sound IF amplifier (Figure 6.4) receives its input signal from a high-Q sound trap in the input converter. It is a four-stage, transformer-coupled amplifier utilizing an undelayed AGC voltage to control the first two forward AGC transistor stages. This AGC voltage is derived from the peak level of the sound signal. The third stage operates as a limiter to further insure that the output sound level remains constant and noise-free. The gain of the fourth stage may be manually set with the SOUND OUTPUT LEVEL control located on the front panel.

4.6 Substitution Carrier

The substitution carrier generator (Figure 6.5) samples the video AGC voltage to determine the status of the received signal. In the event of received signal loss, the substitution carrier replaces the video IF signal. The generator features a nominal on-time delay of ten seconds and an instantaneous off-time. The output level of the crystal-controlled substitution carrier is set by a front panel control.

4.7 Input Converter

Refer to the component location drawing (Figure 4.1) in this section and the schematics (Figure 6.6) in Chapter 6.

The input converter utilizes a low-noise field-effect transistor (FET) RF amplifier (Q1) featuring excellent spurious response rejection and low cross-modulation distortion. Delayed AGC is employed for improved noise-figure performance at

low signal input level, and superior linearity at strong signal levels. The local oscillator is crystal-controlled to provide stable frequency control, independent of environmental changes. Video and sound signals are separated by the converter output, allowing separate AGC circuitry to be employed in the video and sound IF amplifiers. These separately derived AGC circuits reduce the effects of selective fading and facilitate the independent control of video and sound signal levels in the system. Rear panel jumper cables allow convenient access to the inputs of both IF amplifiers for installation of non-duplication switching and emergency alert circuitry.

4.8 Output Converter

Refer to the component location drawings (Figure 4.2) in this section and the schematics (Figures 6.7 and 6.8) in Chapter 6.

The output converter transforms the combined signal to the desired VHF output channel. The local oscillator is crystal-controlled. For on-channel conversion, one local oscillator is used for both the input and output converters, preventing any possible beat frequency interference. A final RF amplifier provides output circuits for 75Ω load which are back-matched to permit loop-through mixing of non-adjacent channel signal processors.

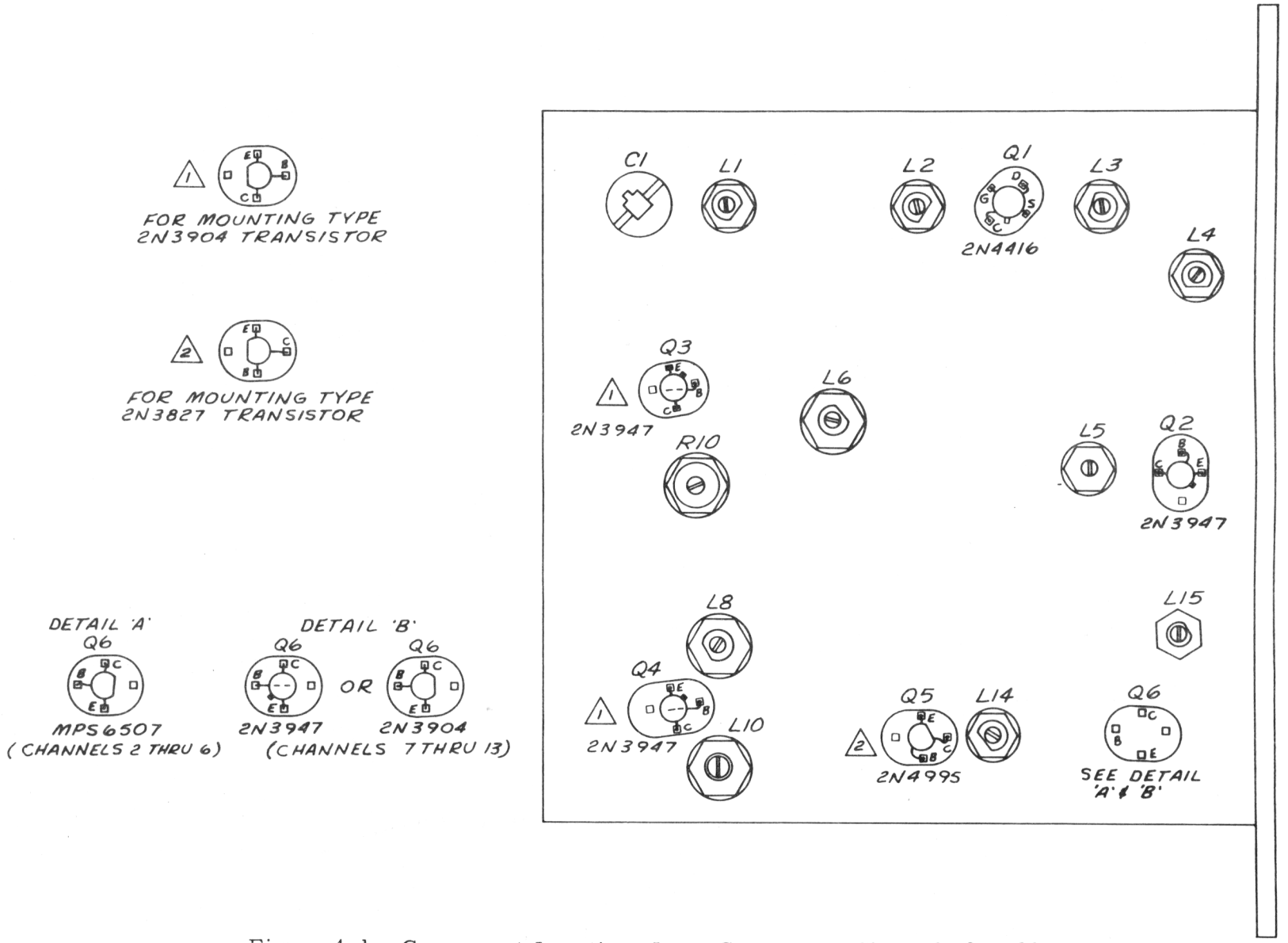
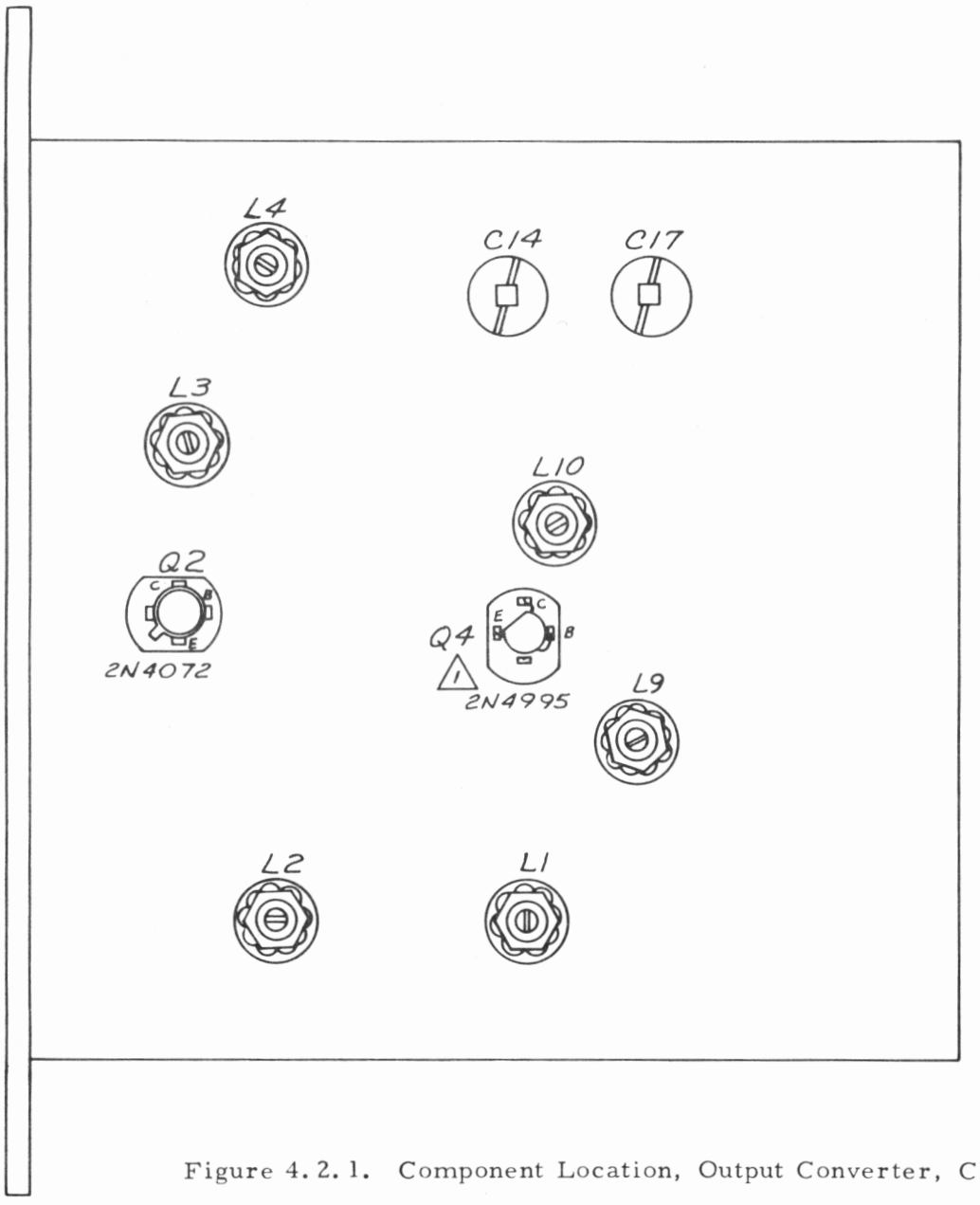


Figure 4.1. Component Location, Input Converter, Channels 2 to 13.



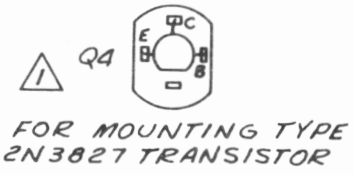


Figure 4.2.1. Component Location, Output Converter, Channels 2 to 6.

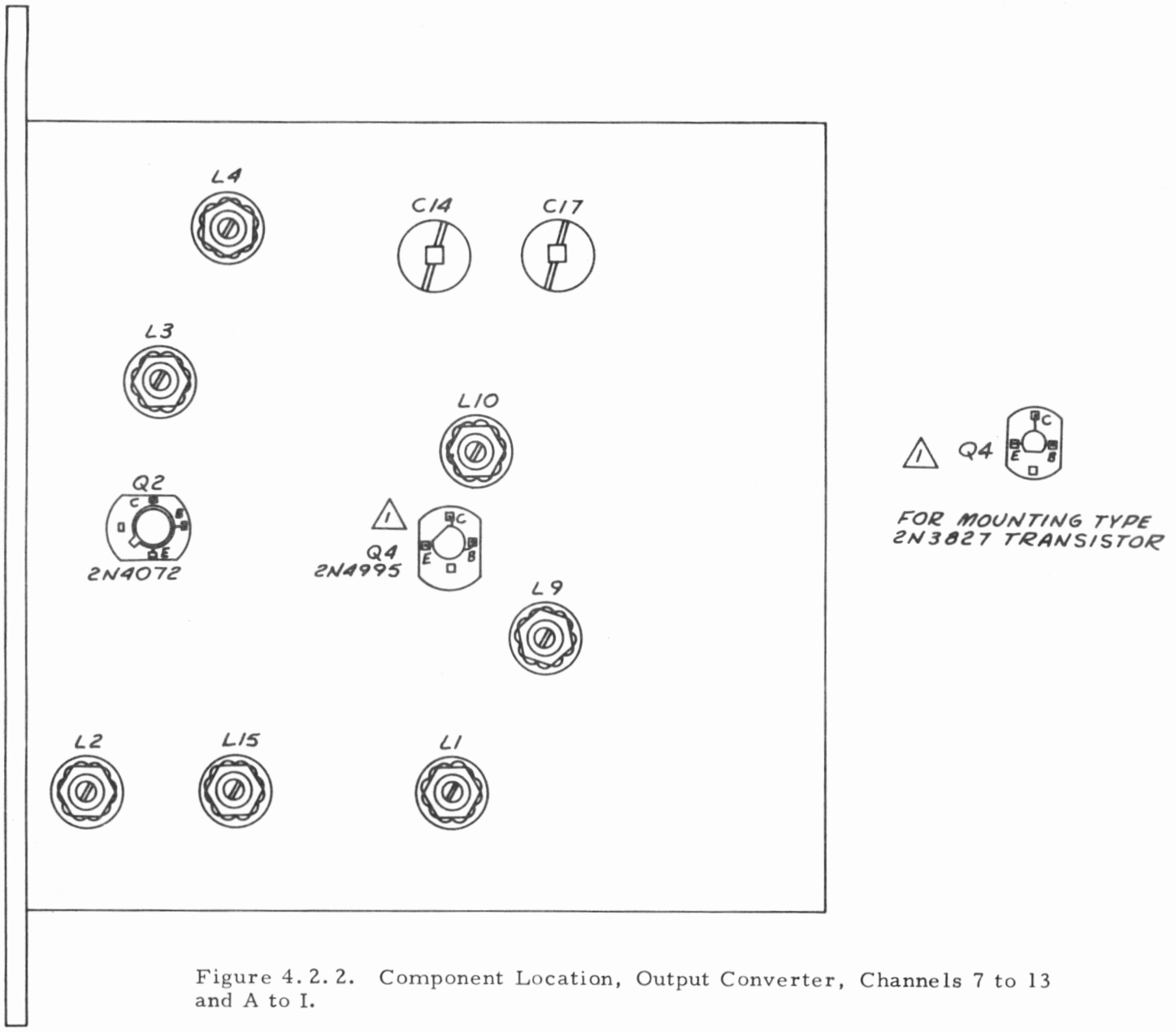


Figure 4.2.2. Component Location, Output Converter, Channels 7 to 13 and A to I.

CHAPTER 5
CHECKOUT PROCEDURES

5.1 Introduction

Chapter 5 contains factory approved check out procedures. It should be noted that the unit has been checked out according to these procedures before shipping; however the customer may require their use in particular installations, or in troubleshooting failures.

5.2 Equipment List

The following test instruments are required for complete checkout of the processor:

(a) Grid-dip-meter, Measurements Model 59, or equivalent.

(b) Frequency Counter, Hewlett-Packard Model 5245L with H-P Model 5253 Plug-in Unit, or equivalent.

(c) RF Voltmeter, Hewlett-Packard Model 3406A, or equivalent.

(d) Sweep generator, Blonder-Tongue Model 4122, or equivalent.

(e) Marker generator, RCA Model WR99A, or equivalent.

(f) Oscilloscope, Tektronix Model 581 or Model 585 with Type 1A7 plug-in unit, X1 and X10 probes, or equivalent.

(g) RF generator, Hewlett-Packard Model 608C.

(h) Variable power supply, Harrison Model 6200B.

(i) Step attenuator, Jerrold Model AV-75, or equivalent.

(j) Telonic Rho-tector, Model TRB-2.

(k) Scientific-Atlanta Video detector.

(l) Impedance Matching circuit, per Figure 5.1.

(m) Field-strength meter, Jerrold Model 704B, or equivalent.

5.3 Main Chassis Checkout Procedure*

The following procedure is used for factory checkout of the main chassis:

(a) Install all plug-in units. (Video IF & AGC, Sound IF & AGC, Substitution carrier, Input converter, Output converter and Power Supply.) Install 3AG 1A slo-blo ac line fuse and connect unit to 110 volts ac.

(b) Using VTVM at B+ test point on rear of chassis, check and adjust B+ for +14.0 volts dc. Potentiometer R1, B+ Control, is located adjacent to B+ test point on rear of chassis. Measure B- on terminal strip adjacent to choke L1 (violet wire). B- should be -5.0 to -7.0 volts dc.

(c) Remove shunt from front panel meter. With front panel meter switch in OFF position, adjust potentiometer R2 (rear panel) for output level meter zero.

(d) (1) Remove cable from connector A1J1 meter circuit box and connect RF output of HP 608 to connector A1J1. Set generator FREQUENCY to 45.75 MHz ±5 kHz. Set 6100 front panel METER switch to VIDEO position and increase generator RF OUTPUT level until approximately 1/2 scale deflection is obtained on meter. Alternately adjust coils A1L3 and A1L7 for maximum deflection on meter. These coils interact, so continue alternate adjustments until no further improvement is noted.

NOTE: Always keep generator output level such that meter deflection is less than full scale.

(2) Set the meter selector switch to SOUND position. Set the HP 608 FREQUENCY to 41.25 MHz ±5 kHz. Adjust capacitor A1C28 for maximum deflection of meter. (Use insulated tuning screwdriver.) Check to assure capacitor peaks at two different locations, verifying capacitor is not tuned to extreme end of range.

(3) Reset generator FREQUENCY to 45.75 MHz ±5 kHz. Leave meter switch in the SOUND position and adjust capacitor A1C21 for null as indicated on the meter. After null is achieved, vary the generator FREQUENCY to verify frequency of null. If null is actually at 45.75 MHz, continue to Step (e). If null is not at 45.75 MHz, determine frequency of null. If low in frequency, spread turns of coil L2 adjacent to capacitor A1C21.

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*Normally performed last in checkout.

(L2 can be adjusted with a soldering aid through access hole for A1R8.) If frequency is too high, remove meter circuit box and replace coil L2 with proper coil.

(4) Repeat Steps (d2) and (d3).

(5) Place selector switch in VIDEO position. Adjust A1R8, A1R9, and A1R10 fully clockwise. Set generator FREQUENCY for 45.75 MHz ±5 kHz. Meter should deflect full scale with approximately twenty to forty milivolts generator output. Place selector switch in SUBSTITUTION CARRIER position, generator FREQUENCY still at 45.75 MHz. Meter should deflect full scale with twenty to forty milivolts generator output. Place meter selector switch in SOUND position. Set generator FREQUENCY for 41.25 MHz ±5 kHz. Meter should deflect full scale with approximately 2 to 5 milivolts generator output.

(6) Disconnect test equipment and replace cable to A1J1. Final calibration will be performed prior to installation of bottom cover when companion output converter is installed.

(e) Set meter selector switch to SUBSTITUTION CARRIER position and adjust coil A5L1 (Substitution Carrier Plugin) for oscillator start-up as observed on 6100 meter. Check oscillator level range and start-up by adjusting front panel SUBSTITUTION CARRIER LEVEL Control (R7) over its range of operation while switching selector switch from SOUND position to SUBSTITUTION CARRIER position.

(f) Determine if processor being checked out is "On" channel conversion (Channel 3 to Channel 3, Channel 8 to Channel 8, etc.) or "Off" channel conversion (Channel 7 to Channel 3, Channel 11 to Channel 5, etc.).

(g) If "Off" channel conversion, remove the input and output converters and set both oscillator switches to OFF position. Replace both converters in main chassis and proceed to Step (j).

(h) If "On" channel conversion, remove both input and output converters and set oscillator switches to ON position.

(i) Set up input and output converter as shown in Figure 5.1 for On-Channel Tuneup. If response is tilted, slight adjustment of output converter coils L3 and L4 will flatten response. Remove converters from test setup and replace in main chassis.

(j) Perform summation sweep by feeding RF output of sweep generator to input connector J2 on rear panel of chassis. Use video detector on output connector J5, (rear of chassis) and connect output of video detector to scope (Tektronix 581 or 585, w/1A7). Terminate connector J6 with 75-ohm "F" Type load. Check to assure jumper cables are in place between J3 and J7, J4 and J8. Using variable power supply connected across C5 (located on connector XA3P1) adjust voltage for +5.5 volts dc. Place all slide attenuators of sweep generator in ON position. Adjust variable RF OUTPUT control and scope SENSITIVITY until all evidence of overload is eliminated. Adjust front panel VIDEO control R3 fully clockwise; SOUND control R12 fully counterclockwise. Observe display and check for tilt. If tilted or not flat within ±1/2 dB, then adjust the primaries of coils L12, L14, and L16 (BOTTOM SLUG) until flat response is obtained.

(k) Remove 5.5 volts from C5. Connect OUTPUT of HP 608 to INPUT connector J2. Adjust generator RF OUTPUT for three millivolts. Use a VTVM and measure delayed AGC voltage on Pin 3 XA6P1. Adjust potentiometer R27 (video IF plugin) for −0.7 volts dc. Remove HP 608 and measure insertion gain of Model 6100 Processor by attenuator substitution method. Check both video and sound gain (video gain should be greater than 80 dB; sound gain should be greater than 75 dB). Make sure measurements are performed at a level which precludes limiting.

(l) Remove all test equipment and feed RF output of HP 608 into connector J2. Terminate connector J5 with 75-ohm "F" load. Connect J6 to Jerrold field-strength meter. Adjust FREQUENCY of HP 608 to picture frequency of channel being checked and set output level for +5 dBmV. Place meter selector switch of Model 6100 Processor in VIDEO position. Adjust front panel VIDEO control R3 for +55 dBmV as read on Jerrold field-strength meter. Adjust potentiometer A1R10 (meter circuit box) for Model 6100 meter reading of +55 dBmV. Place meter selector switch in SUBSTITUTION CARRIER position and adjust front panel SUBSTITUTION CARRIER control R7 for +55 dBmV as read on Jerrold field-strength meter. Adjust A1R8 (meter circuit box) for Model 6100 meter reading of +55 dBmV. Place meter selector switch in SOUND position; set HP 608 FREQUENCY for sound frequency of channel being checked. Set 608 OUTPUT level for 0 dBmV. Adjust SOUND LEVEL control R12 for +40 dBmV on Jerrold field strength meter. Adjust A1R9 (meter circuit box) for Model 6100 meter reading of +40 dBmV. Remove test equipment.

(m) Rotate Sensitivity control R5 (rear of Chassis) fully counterclockwise. Connect HP 608 RF output to connector J2. Set 608 OUTPUT level for 0 to 5 dBmV. Alternately make small clockwise adjustments to R5 and remove 608 from J2. Wait approximately thirty seconds to see if front panel SIGNAL OFF light operates. Continue clockwise adjustments until SIGNAL OFF light starts operating with a delay of approximately ten to fifteen seconds after removal of 608 signal. Set lock on R5. Remove all test equipment.

(n) Place bottom cover on Model 6100 Processor.

5.4 Input Converter Checkout Procedure

The following procedure is used for factory checkout of the input converter:

(a) Check to see if jumper from emitter of Q5 to crystal socket is loose. If not loose, temporarily unsolder one end of jumper.

(b) Using a grid-dip-meter (Measurements Model 59), resonate coil L12 at frequency of crystal ±3 MHz (put meter in OSCILLATOR position and dip will be observed as meter is tuned through resonance). Coil frequency can be adjusted by spreading or squeezing turns. Replace jumper wire unsoldered in step (a).

(c) Apply B+ to converter (+14.0 volts). Use HP Counter 5245L with Model 5253B Plugin and a Tektronix X1 probe connected to the emitter of Q6. Adjust oscillator coil L14 for oscillator lock-in and peak by observing meter on 5253B plugin. Oscillator frequency should be within ±20 kHz of that shown on crystal. Switch B+ OFF and ON several times to assure oscillator startup.

(d) Remove probe from Q6 and, using HP 3406 Voltmeter attached to emitter of Q2, adjust coil L15 for maximum. (Should read 150-300 mv). Turn off B+.

(e) Temporarily remove oscillator transistor Q5. Connect "BNC" connector (Figure 5.2) to emitter of Q2 through a 0.0015μF capacitor. Connect sweep generator (Blonder-Tonque 4122) RF output to "BNC" connector. Connect Scientific-Atlanta Video Detector to video output connector J4. Output of detector should connect to oscilloscope (581 or 585, with 1A7 plugin). Apply B+ to converter.

(f) Set scope SENSITIVITY for 5 mv/cm and adjust sweep generator RF OUTPUT for approximately three divisions (cm) of display. Sweep generator center frequency and width should allow observation of approximately 40 to 48 MHz.

(g) Place marker generator at 41.25 MHz. A notch or dip in the display should be apparent. Adjust potentiometer R10 until this notch bottoms out. (See Figure 5.4). Adjust coil L6 until this notch is centered at 41.25 MHz. Adding side covers to the converter will change notch frequency, so final adjustment should be made with covers in place. Adjust L5, L8, and L10 until the response shown in Figure 5.5 is obtained. Coil L5 controls the response on the left edge, L8 the response in the center, and L10 the response on the right edge of the display. Side covers will also affect the response adjustments, so final adjustments should be made with covers in place over the exposed wiring side. Make sure that L5 is adjusted such that a marker at 41.6 MHz is on the top of the display and not on the slope.

(h) See Par. 5.8, VSWR Measurements. Apply B+, ground AGC. Measure and adjust input VSWR with Rho-tector connected to connector J2. Adjust L1, L2, and C1 for response shown in Figure 5.6. Use the fingers of one hand to shunt L3 to ground during L1, L2, and C1 adjustments. Remove fingers shunting L3 and adjust neutralizing capacitor C5 for response similar or identical to that obtained when fingers were shunting L3. If large adjustment of C5 is required (greater than two turns), repeat the first part of this step.

(i) Replace oscillator transistor Q5. Apply B+ (+14 volts). Apply an AGC voltage of -0.5 volts to AGC pin of power connector. Connect Sweep Generator RF output to input connector J2. Connect Scientific-Atlanta Video Detector to video IF connector J4. Output of detector connects to oscilloscope (581 or 585, with 1A7 plugin). Adjust L3 and L4 until response shown in Figure 5.7 is obtained. Again place side covers on converter when making final adjustments. If flat response cannot be obtained by adjusting L3 and L4, slight adjustment to L5, L8, and L10 should allow the response shown in Figure 5.7 to be achieved.

(j) Refer to Step (h) and recheck input VSWR (should be less than 1.25:1). If out of specifications, repeat step (h).

(k) Recheck overall response as in step (1). If response meets specifications, change Scientific-Atlanta Video Detector to sound IF connector J3. Response as shown in Figure 5.8 should be observed.

(l) Replace video detector to connector J4 and measure insertion gain of converter by the attenuator substitution method. Channel 2 through Channel 6 converters should have 30 dB gain minimum. Channel 7 through Channel 13 should have 20 dB minimum gain.

5.5 Sound IF and AGC Checkout Procedure

The following procedure is used for factory checkout of the sound IF and AGC module:

(a) Remove mutual-coupled traps from coils L3 and L9.

(b) Apply B+ (+14 volts) to power connector. Temporarily connect 250-ohm, 1/4-watt resistor across C28.

(c) Refer to Par. 5.8, VSWR Measurements; and connect Rho-tector to output connector P3. Adjust coil L8 for minimum VSWR at 41.25 MHz.

NOTE: Double check accuracy of frequency for this and all remaining coil adjustments.

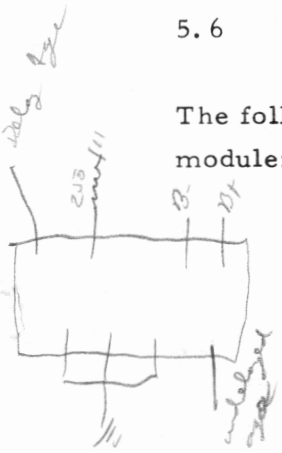
(d) Remove all VSWR test equipment and set up sweep test circuit (connect sweep generator RF output to input connector P2). Connect output connector P3 through Scientific-Atlanta Video Detector to Tektronix 581 or 585, with 1A7 plugin. Scope SENSITIVITY should be set for 1 mv per division and display should be adjusted to approximately two divisions of amplitude. Alternately adjust coils L1, L3, L7, and L9 for maximum response at 41.25 MHz. These coils interact with each other, so continue alternate adjustments until no further improvement is noted.

(e) Replace mutual-coupled traps on coils L3 and L9. Space both traps approximately 1/4 inch from primaries and adjust both traps for null at 39.75 MHz. After nulling each trap, retune the primaries of L3 and L9 to 41.25 MHz (traps will slightly detune resonant frequency of coils L3 and L9).

(f) Remove sweep equipment and connect RF output of HP 608 Signal Generator to input connector P2. Connect output connector P3 to HP RF Voltmeter (3406A). Set generator FREQUENCY for 41.25 MHz

and OUTPUT LEVEL for 1 mv. Voltmeter should be set for 100 mv full scale. For generator output level changes from 1 to 100 mv, the output level as read on the voltmeter should vary less than ±2 dB. (Output level will be approximately 30 mv.)

(g) Remove all test equipment and connections to power connector. Install top cover.



5.6 Video IF and AGC Checkout Procedure

The following procedure is used for factory checkout of the video IF and AGC module:

(a) Set potentiometers R2, R27, R41, R43, and R55 to midrange (for initial adjustment only). Remove mutual-coupled traps from coils L12, L14, and L16.

(b) Place 250-ohm, 1/4-watt resistor in parallel with C69 (it is recommended that four 1000-ohm resistors be paralleled and alligator clips soldered to the leads). Apply B+ (+14 volts) and B– (–6 volts). Use RCA VTVM and measure AGC voltage across C67. Adjust R43 for minimum voltage. Adjust R54 for 4.0 volts. Readjust R43 counterclockwise for 4.1 volts. This completes AGC voltage setup.

(c) Using a variable power supply, apply +5.5 volts to AGC pin of power connector.

(d) Refer to Par. 5.8, VSWR Measurements and connect Rho-tector to input connector P2. Adjust coil L1 for best input VSWR (less than 1.25:1) from 41 to 47 MHz. Spread or squeeze turns to increase or decrease frequency. See Figure 5.9 for typical display.

(e) Measure and adjust output VSWR with Rho-tector connected to connector P3. Tuning of coils L19 and L20 should give response as shown in Figure 5.10.

(f) Remove the VSWR test equipment and connect the RF output of sweep generator to connector P2. Connect video output P3 through a Scientific-Atlanta Video Detector to oscilloscope (Tektronix 581 or 585, with 1A7 plugin). Set scope VERTICAL SENSITIVITY for 10 mv/cm. Using RCA Marker Generator WR-99A (and being very careful to zero-beat frequencies), adjust coil L5 for a null at 47.25 MHz. If coil slug does not allow adequate tuning range, expand or

compress turns of coil to position null at 47.25 MHz. Once proper frequency is achieved, adjust potentiometer R2 for maximum depth of null.

(g) Adjust coil L8 for null at 48.00 MHz.

(h) Adjust coil L9 for null at 39.75 MHz.

The following adjustments control bandpass response as noted.

(i) Adjust L10 for flat response around 46 MHz.

(j) Adjust L7 until 41.50 MHz is at the top of the response as shown in Figure 5.11.

(k) Adjust L4 until overall response is approximately flat from 41.5 MHz to 46.5 MHz.

(l) Adjust L12, L14, and L16 for maximum amplitude of overall response.

(m) Response at this point should be similar to Figure 5.12. The slight humps at each end of the band (approximately 41.5 and 46.5 MHz) will be squared off by mutual-coupled traps.

NOTE: During mutual-coupled trap alignment, increase display amplitude until notches are well defined.

(n) Replace mutual-coupled trap (5T and 62 pf) on coil L12 approximately 1/4 inch from primary. Adjust null frequency for 39.75 MHz. Decrease spacing and retune null for 39.75 MHz until response is squared off on left edge.

NOTE: Make sure response is on top at 41.5 MHz. Spacing between trap and coil primary should be approximately 1/8 inch.

(o) Replace mutual-coupled trap (5T and 43 pf) on coil L14. Space 3/8 inch from primary of L14 and adjust null for 48.00 MHz.

(p) Replace mutual-coupled trap (5T and 43 pf) on coil L16. Space 3/8 inch from primary L14 and adjust null for 48.00 MHz.

(q) Readjust display for approximately two divisions and adjust L10, L7, and L4 for maximum flatness of response. Adjust L12, L14, and L16 for maximum gain. Response should be as shown in Figure 5.13.

NOTE: 41.50 MHz marker must be on top of response.

AGC ALIGNMENT

(r) Remove video detector from P3. Connect Tektronic 581 or 585 Scope, with 1A7 plugin and X10 probe at junction of CR2 and R42. Set scope display for 1 mv/cm and adjust L23 for maximum amplitude of display. Display will be similar in shape to Figure 5.13.

(s) Remove +5.5 volt power supply from AGC and measure insertion gain of IF by attenuator substitution method. Factory only: units with 40 to 45 dB gain should be marked for use on Channels 2 through 6, units with gain greater than 45 dB should be marked for use on Channels 7 through 13.

5.7 Output Converter Checkout Procedure

The following procedure is used for factory checkout of the output converter:

(a) Check to see if jumper from emitter of Q4 to crystal socket is loose. If not, temporarily unsolder one end of jumper. Check junction of C8 and L2. If C8 is not loose at this junction, temporarily unsolder C8 from L2.

(b) Use a grid-dip-meter (Measurements Model 59) and resonate coil L11 at frequency of crystal ±3 MHz (put meter in oscillator position and dip will be observed as the meter is tuned through resonance). Coil frequency can be adjusted by spreading or squeezing turns.

(c) Replace jumper between emitter of Q4 and crystal socket. Place oscillator switch in off-channel position (see Figure 5.14).

(d) Apply B+ to converter (+14.0 volts). Using a HP Counter 5245L with 5253B plugin, and Tektronix X1 probe at junction of C25 and S1, adjust L10 (oscillator coil) for oscillator lock-in: observe the indicator on the 5253B plugin and adjust L10 for maximum oscillator output. Switch B+ off and on several times after adjustments to assure oscillator starts up. Frequency of oscillation should be less than ±20 kHz of that on crystal. Remove probe.

(e) Hold RF Voltmeter probe (HP 3406) to 1 pF feedthrough C1 and peak L9 (this reading should peak at 400 ±100 mv). Remove probe.

(f) See Figure 5.3. Attach loose end of C8 to BNC connector. Connect RF sweep generator output (Blonder-Tonque 4122) to this point. Marker generator (RCA WR-99A) should be used to adjust sweep width and center

frequency for display of channel being aligned. Connect oscilloscope (Tektronix 581 or 585, with 1A7 plugin) to output connector J4 through Scientific-Atlanta Video Detector. Connect 75-ohm termination to output connector J5. Adjust coils L3 and L4 to peak at center of channel being aligned (see Figure 5.15). Scope sensitivity should be approximately 50 mv per division and sweep generator output should be set for three to four divisions of display.

(g) Disconnect scope and sweep generator. Connect RF output of HP 608 signal generator to output connector J4. The 75-ohm termination should still be on J5. Connect RF voltmeter to BNC connector temporarily installed in step (f). Adjust HP 608 for center of channel being tuned (half-way between sound and picture frequencies) and set RF output level for approximately 500 mv. Adjust neutralizing capacitor C8 for minimum voltage as read on voltmeter.

(h) Repeat steps (f) and (g).

(i) If last adjustment of C8 in step (h) requires less than two turns, go to step (j). If adjustment required more than two turns, repeat steps (f) and (g) again.

(j) Remove test equipment, turn off B+. Remove temporary BNC connector and solder loose end of C8 to junction of C6 and L2.

(k) Feed RF output of sweep generator into connector J2 (IF input) through impedance matching circuit (see Figure 5.20 for schematic diagram of impedance matching circuit). Place oscillator switch S1 in off-channel (oscillator on) position. (See Figure 5.14.) Place Video Detector in output connector J4 and 75-ohm termination in output connector J5. Output of Video Detector should go to 1A7 scope plugin. Apply B+ to converter and adjust scope display for approximately three divisions of display at sensitivity of 10 mv/cm. This input circuit accepts the IF frequencies (approximately 41 to 46 MHz). More than one response will be seen. Use largest response on Channel 5 and 6. Use second largest response on all other channels (should be the lowest frequency response).

(l) Adjust L1 and L2 for bandpass response as shown in Figure 5.16. Capacitor C6 can be adjusted for bandwidth changes. If a flat response cannot be obtained with L1 and L2, slight adjustment of L3 and L4 can be made to compensate for tilt.

(m) Disconnect all test equipment (refer to Par. 5.8, VSWR Measurements). Apply B+ to converter and connect Rho-tector to output connector J4. Place 75-ohm termination on connector J5. Adjust output VSWR for minimum (less than 1.5:1) by tuning C14 and C17. If necessary, slightly readjust neutralizing capacitor C9 to achieve VSWR less than 1.5:1 across 54 to 216 MHz. See Figure 5.17 for typical display of output VSWR.

(n) Final touch-up is accomplished by sweep measurements. Connect RF output of sweep generator to input connector J2. Connect Video Detector to output connector J4 and 75-ohm termination to output connector J5. Output of Video Detector should go to 1A7 scope plugin. Set scope SENSITIVITY for 50 mv/cm and generator RF OUTPUT for approximately three divisions of display with B+ turned on.

(o) Touch up L1, L2, L3, and L4 for flat response and proper bandpass (see Figure 5.16). Check insertion gain by attenuator substitution method. (Should be greater than 15 dB.)

(p) Tightly lock all coils.

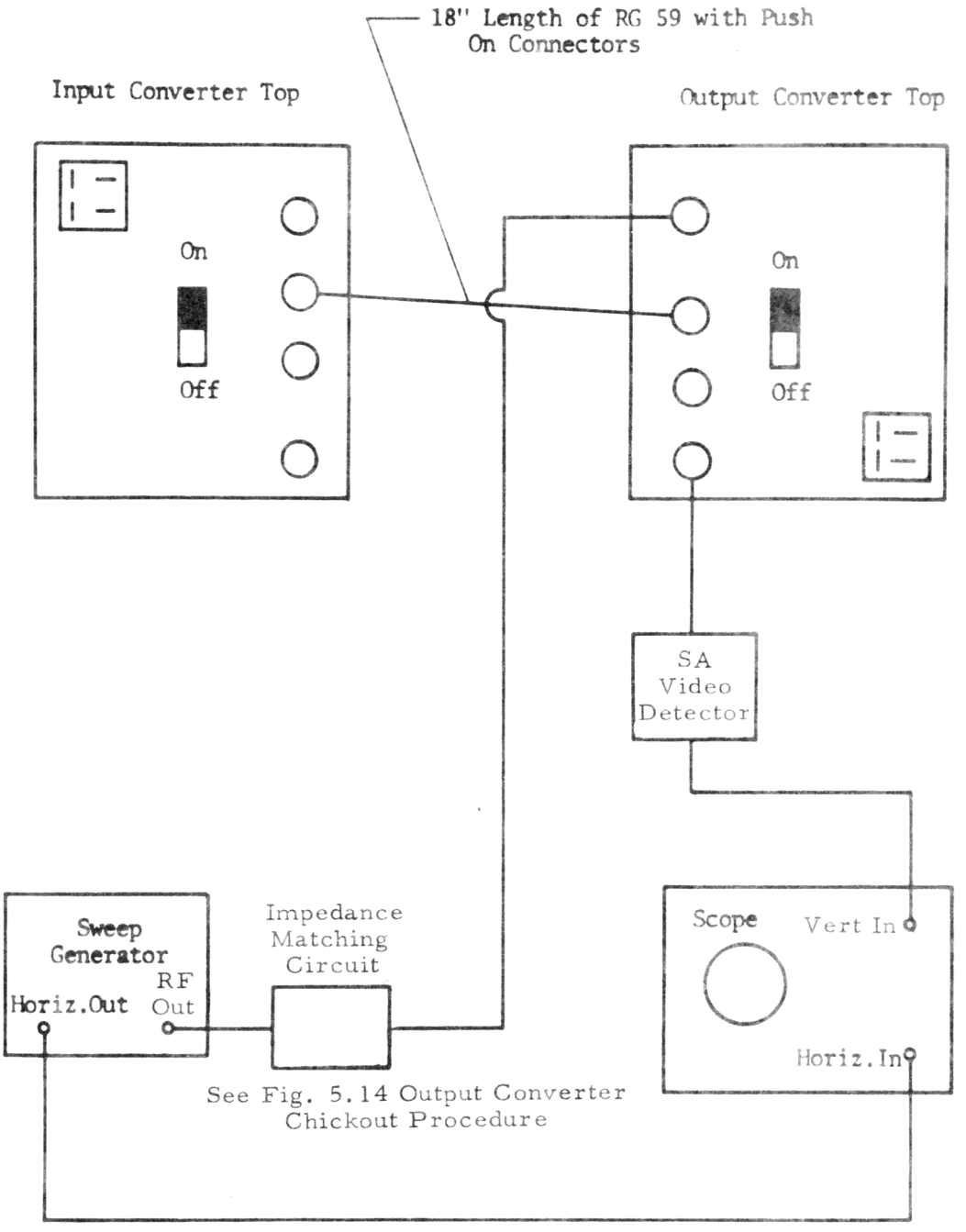
5.8 VSWR Measurements

The following procedure may be used to calibrate the Rho-tector for a voltage-standing-wave-ratio of 1.5:1.

(a) Refer to Figure 5.18 and arrange and interconnect test equipment as shown.

(b) Calibrate for VSWR measurements as follows:

(1) Terminate "Z_2" part of Rho-tector with a 50-ohm load.
(2) Set scope vertical input sensitivity to 1 mv/cm.
(3) Adjust sweep generator RF output for 2 cm of vertical deflection and sweep width for a 2-cm horizontal display between video and sound carrier frequencies for the desired channel (see Figure 5.19). If interested in frequencies other than the sound and video carriers, set sweep generator width and center frequency accordingly. This display represents a VSWR of 1.5:1.
(4) Remove the 50-ohm load and substitute the device or circuit to be tested.



NOTE: Apply B+ to Both Converters.

Fig. 5.1. Setup for On-Channel Tuneup

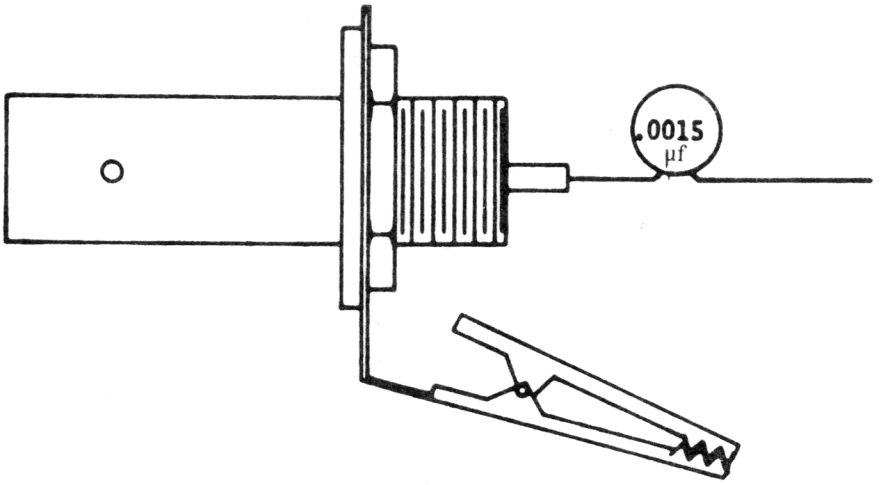


Fig. 5.2. Adapter - BNC (With Capacitor)

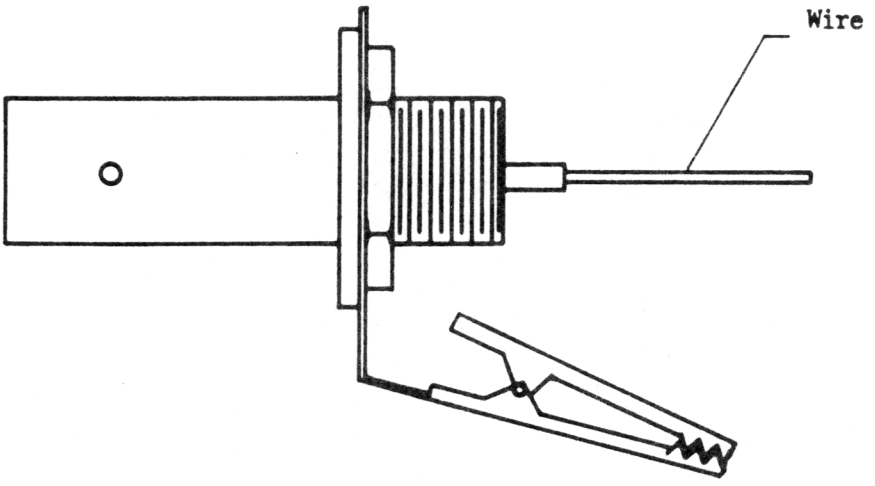


Fig. 5.3. Adapter - BNC

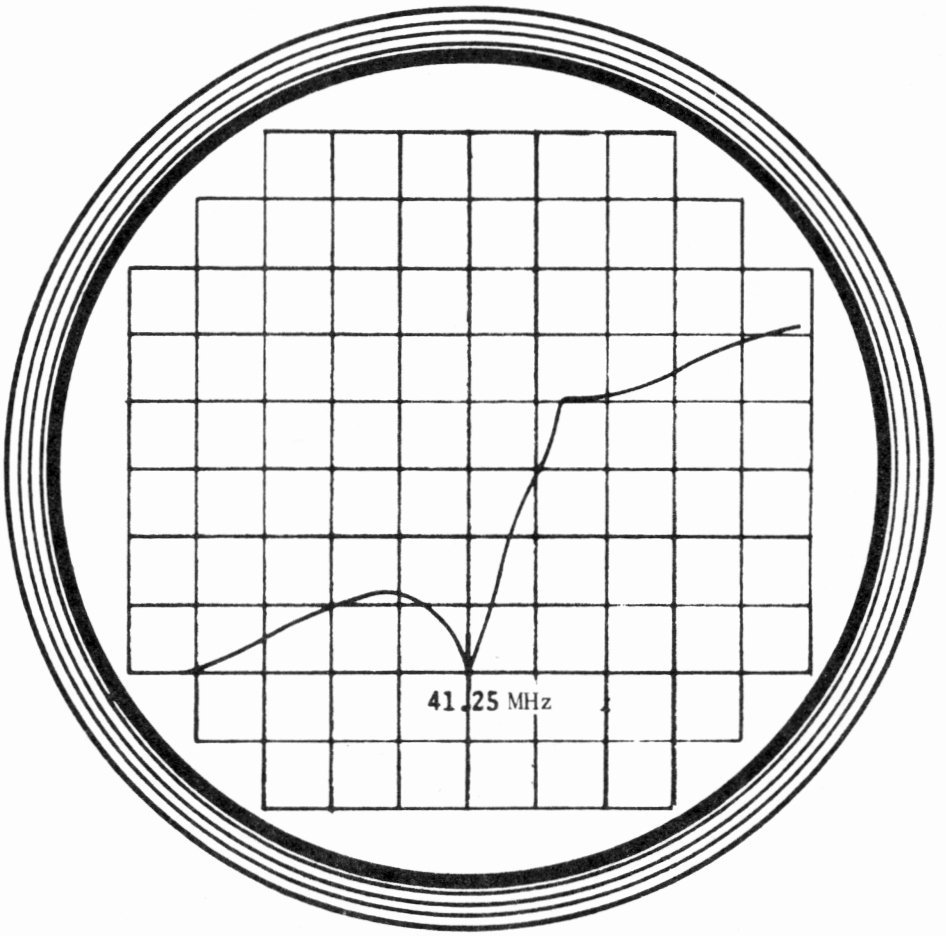


Fig. 5.4. Input Converter - Initial IF Bandpass Response Showing Sound Notch

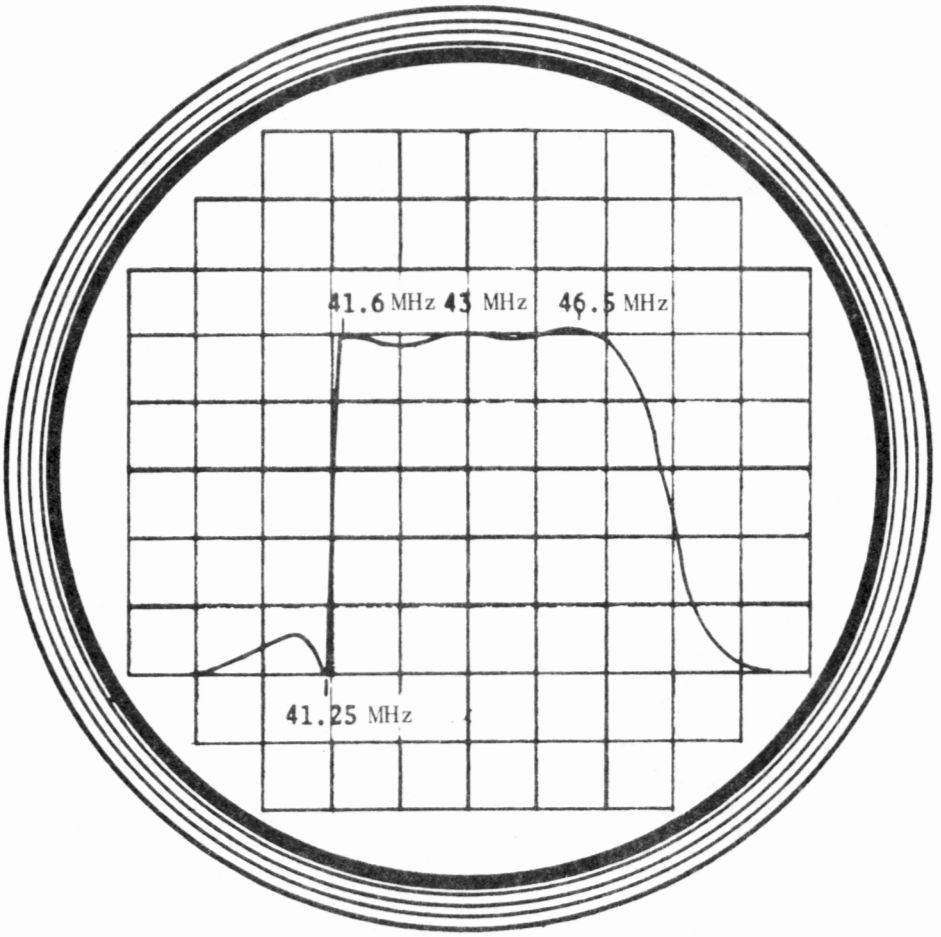


Fig. 5.5. Final IF Bandpass Response

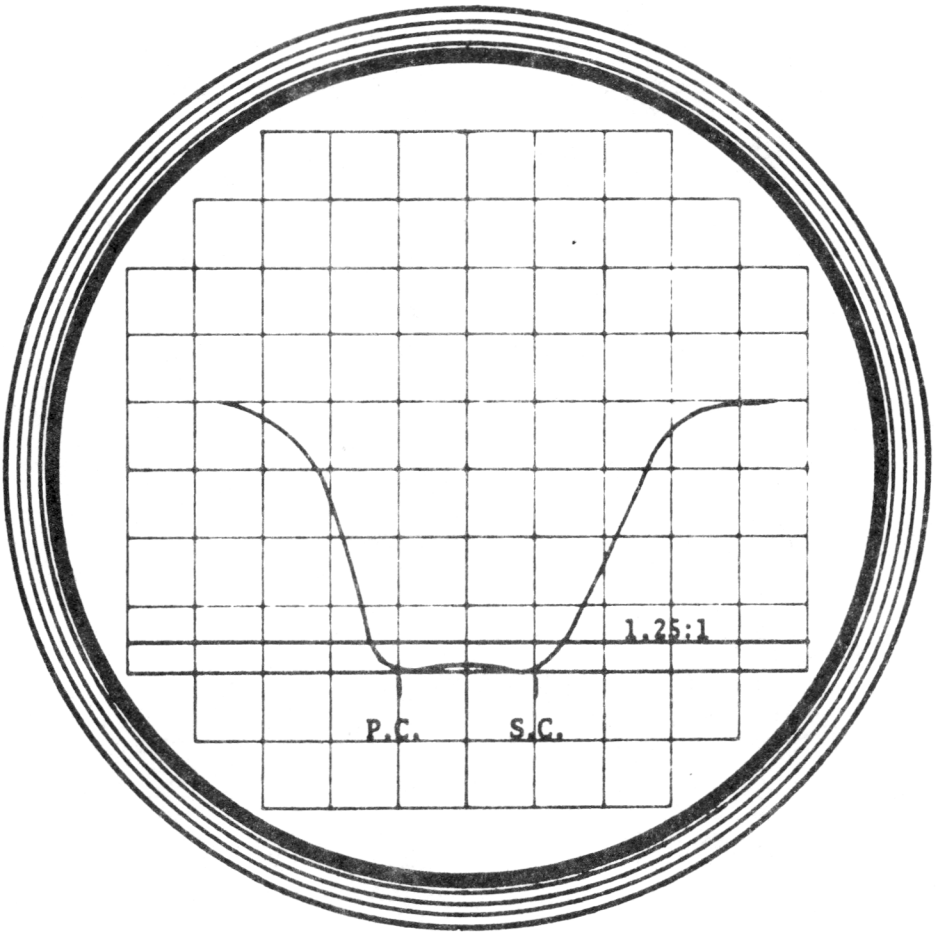
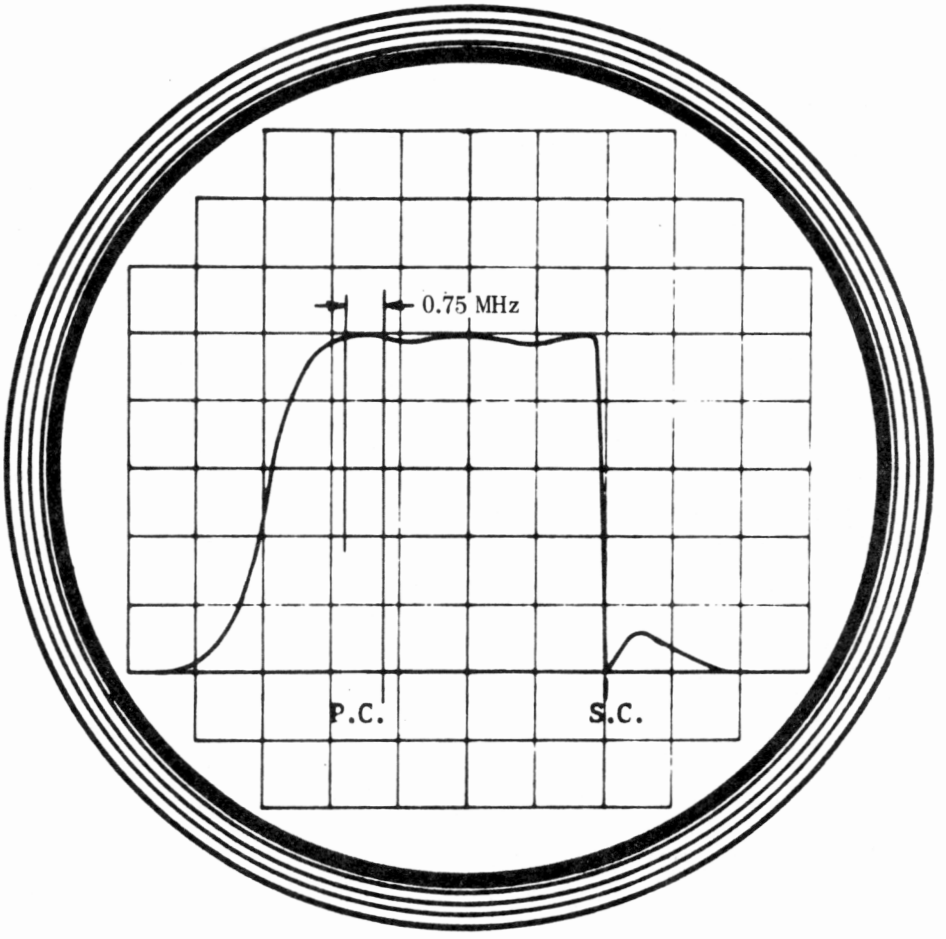


Fig. 5.6. Input VSWR, Input Converter



Note: Response must remain flat 0.75 MHz beyond picture carrier.

Fig. 5.7. Overall Bandpass Response, Input Converter

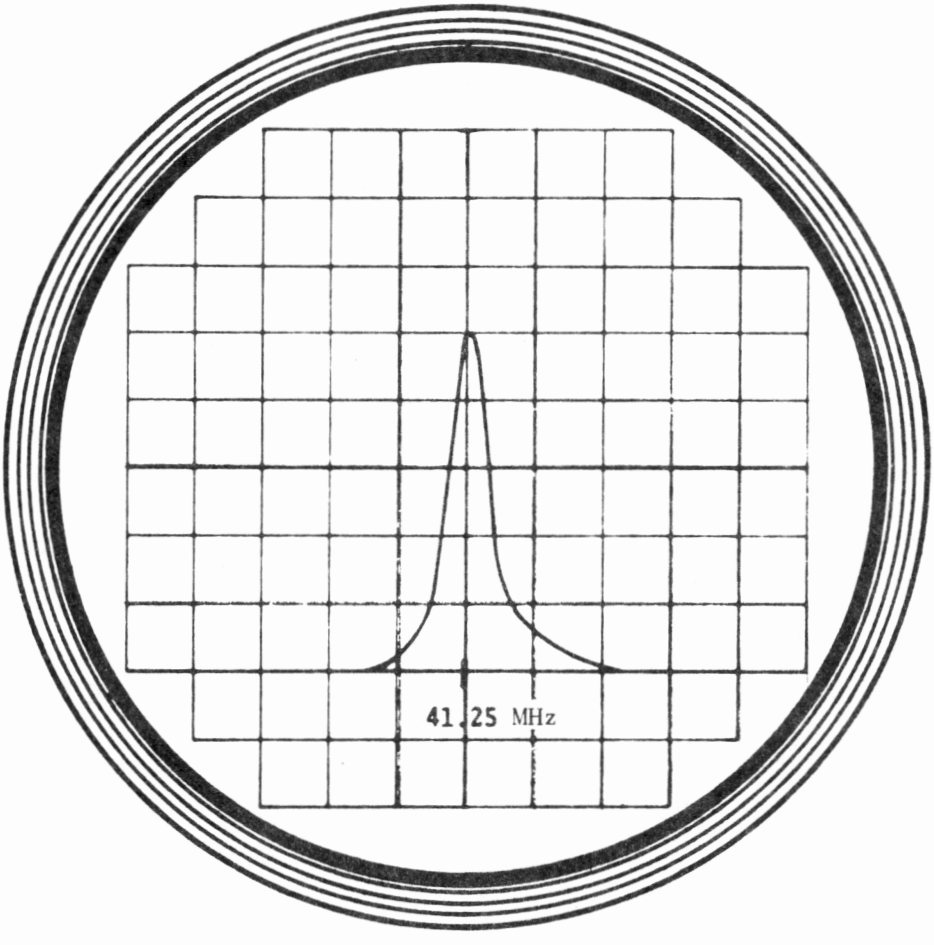


Fig. 5.8. Sound Response, Input Converter

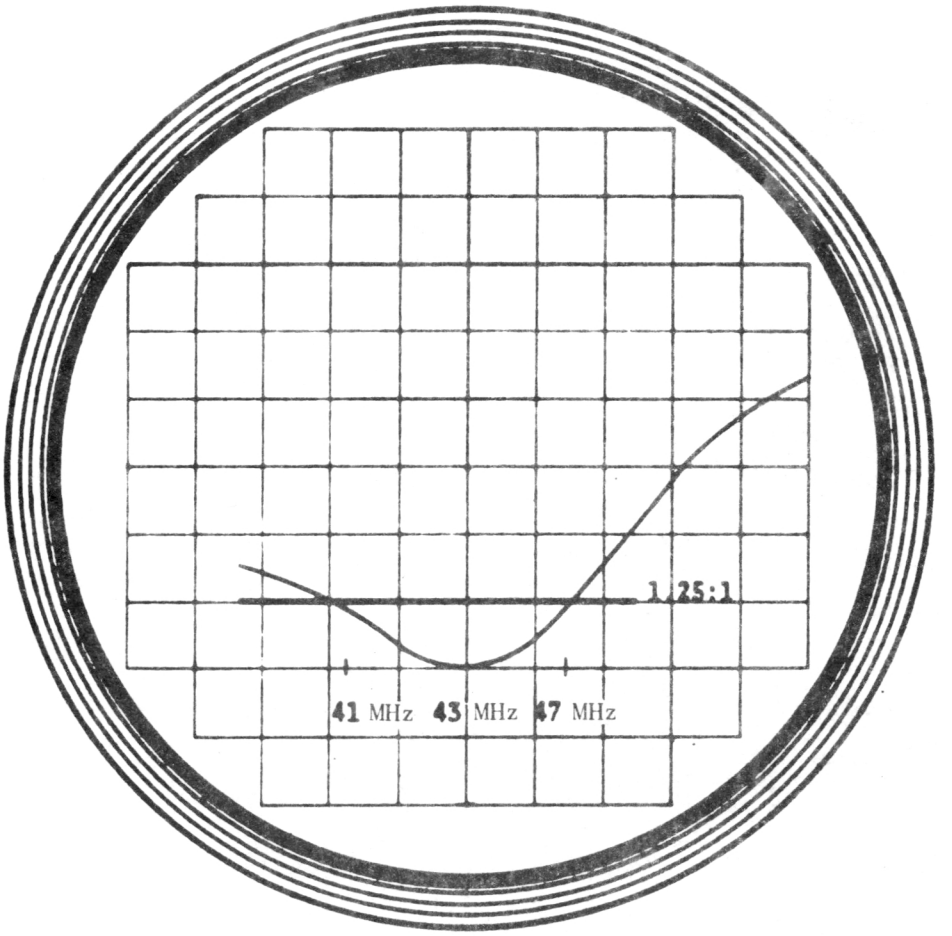


Fig. 5.9. Input VSWR, Video IF

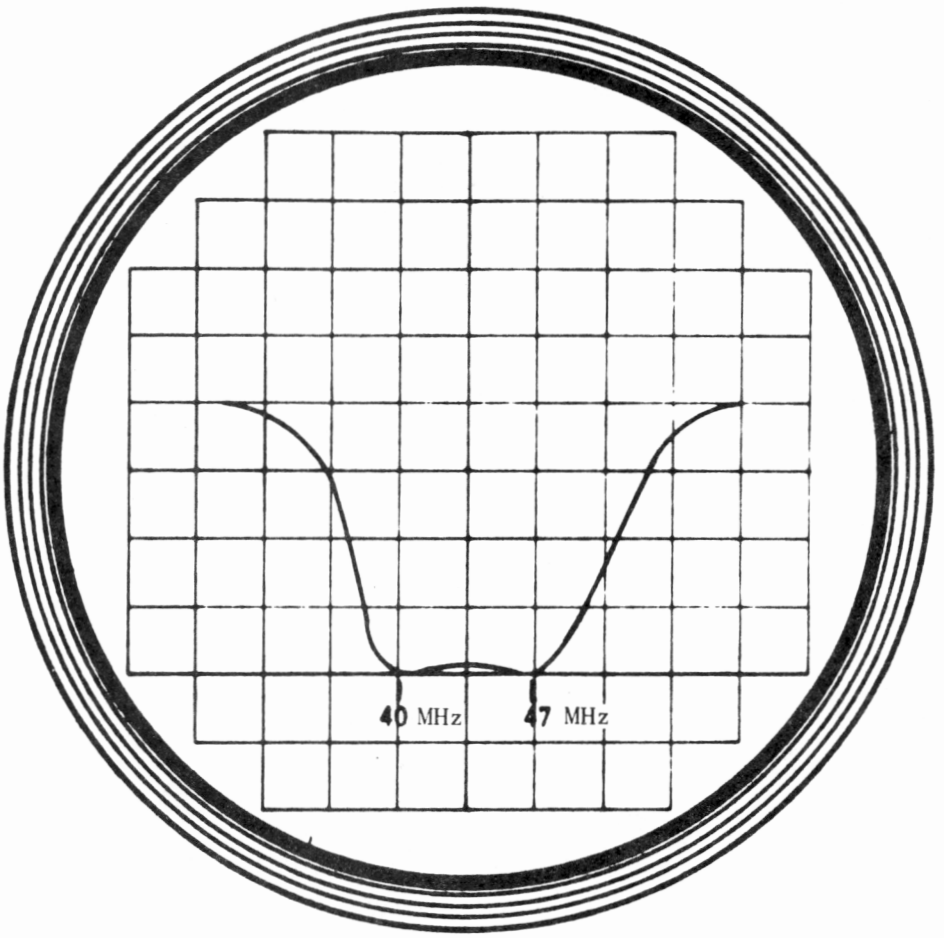


Fig. 5.10. Output VSWR, Video IF

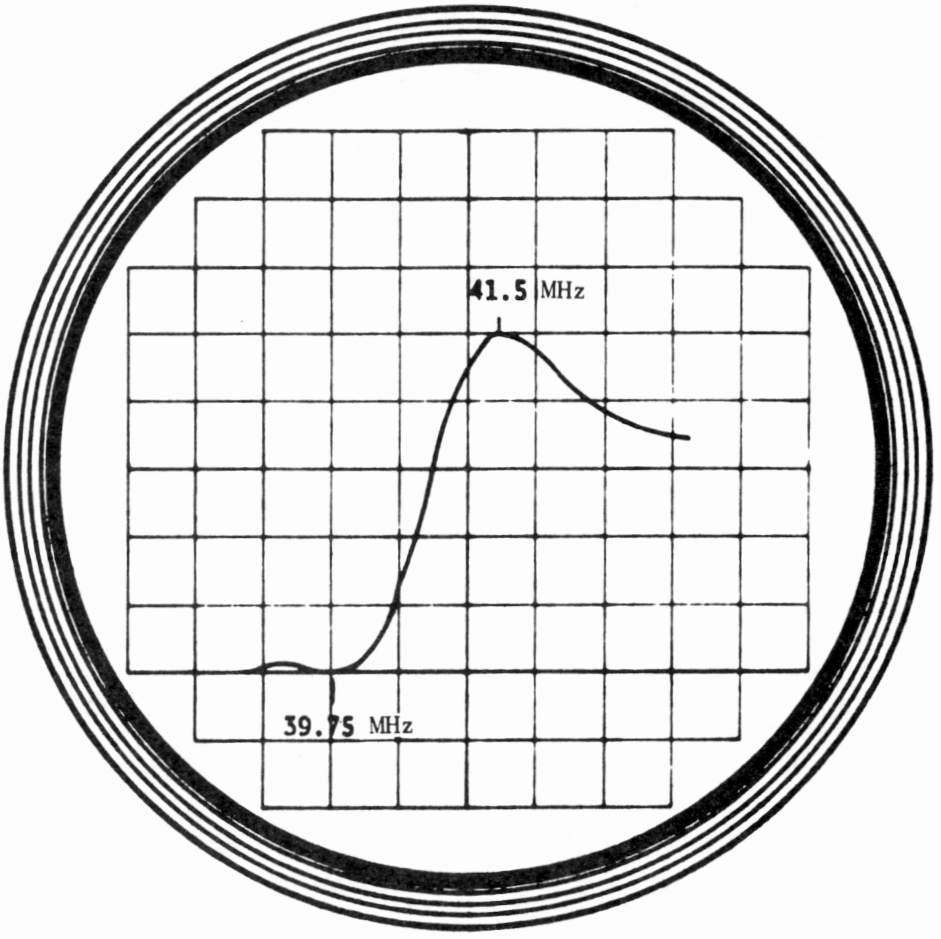


Fig. 5.11. Typical Response Showing 41.50 Mc Marker, Video IF

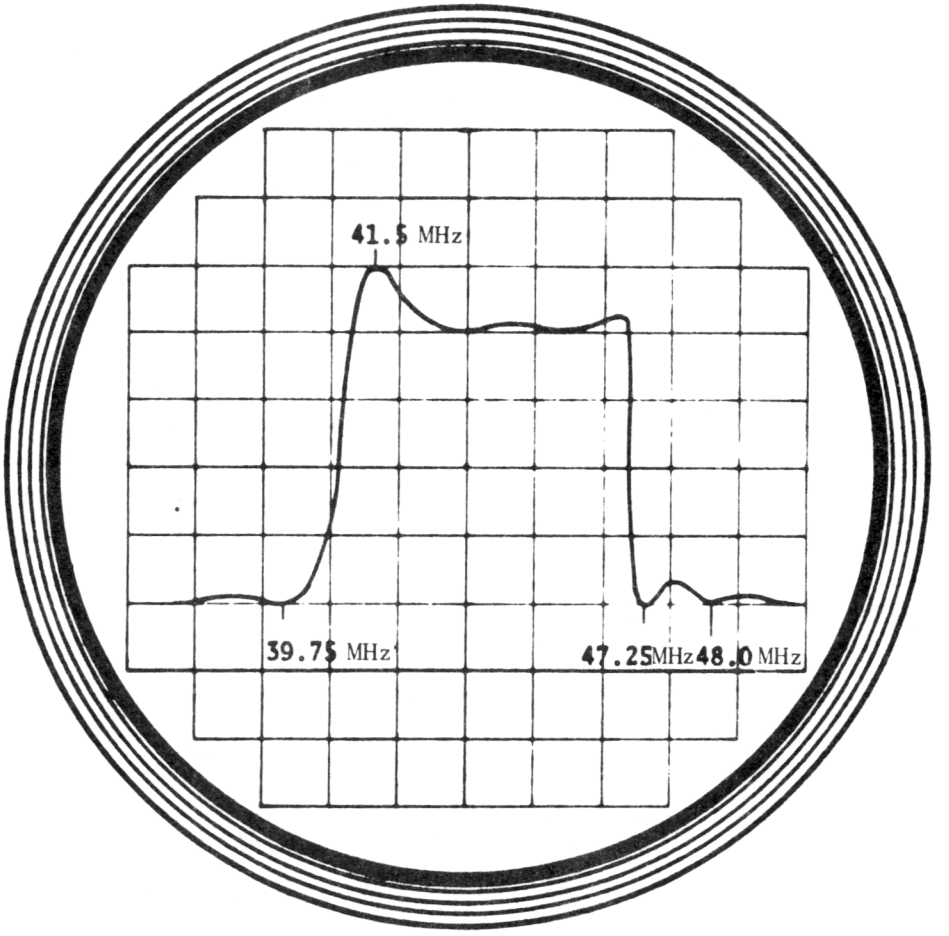


Fig. 5.12. Preliminary Overall Bandpass, Video IF

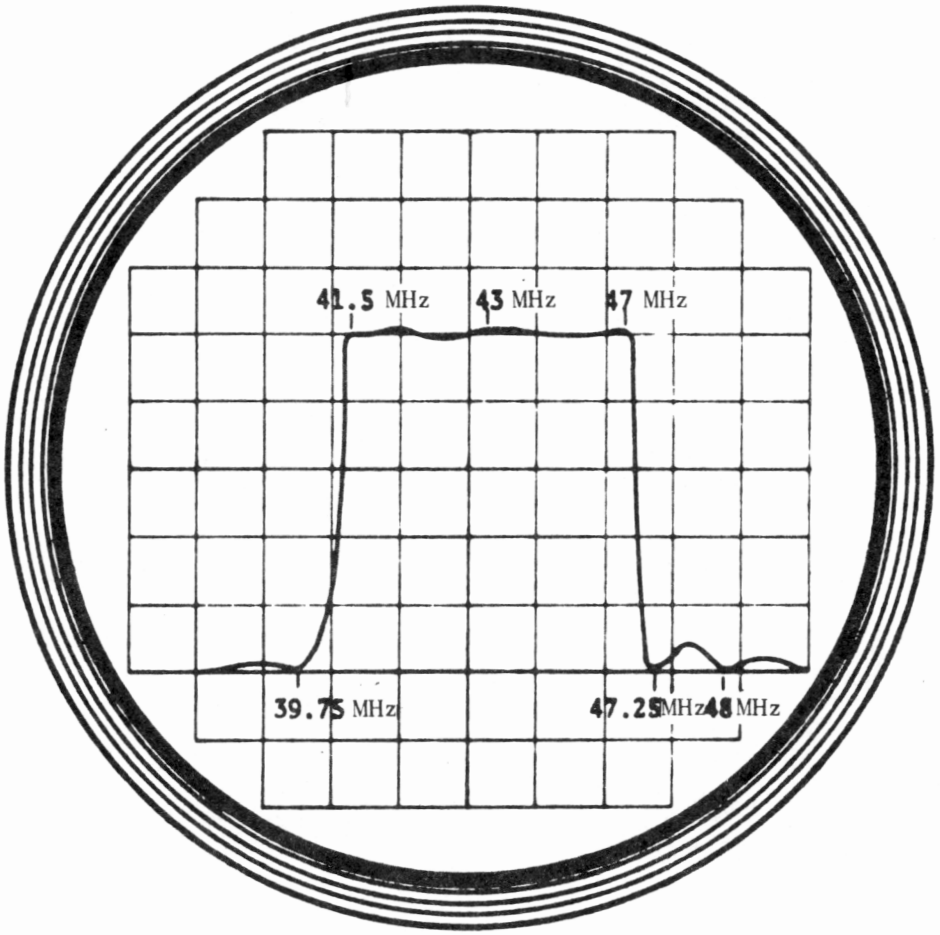


Fig. 5.13. Typical Final Bandpass Response, Video IF

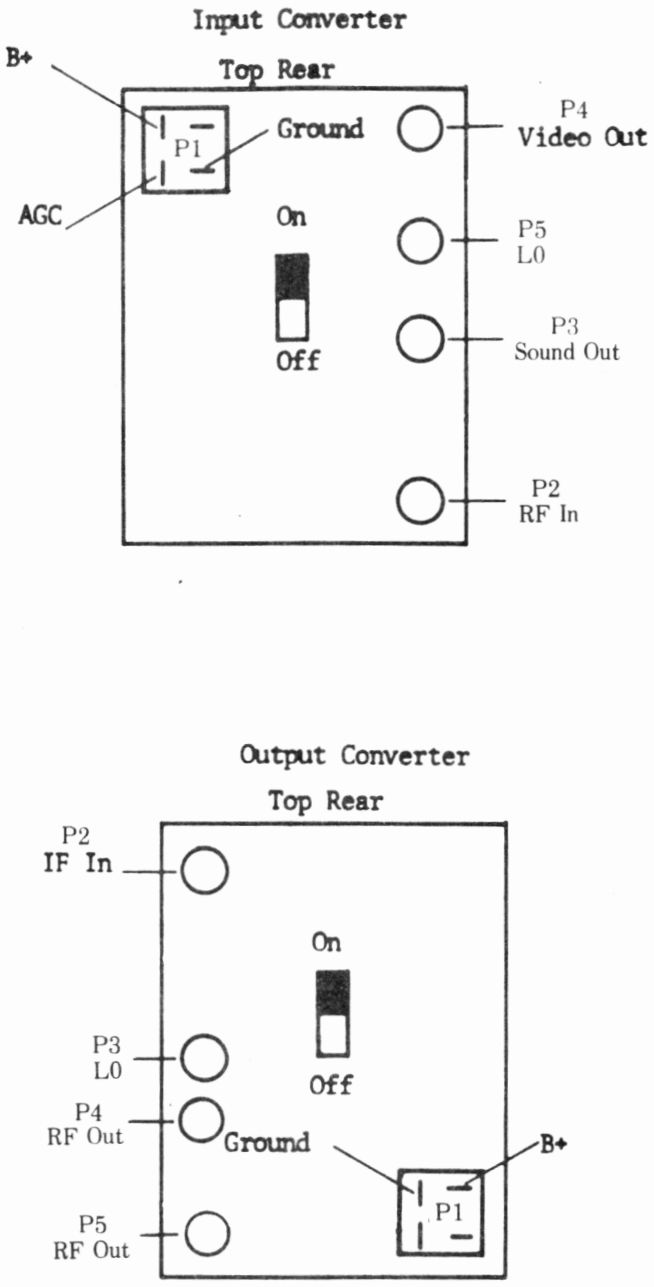


Fig. 5.14. Local Oscillator Switch Positions and Power Connections, Input and Output Converters (Rear View)

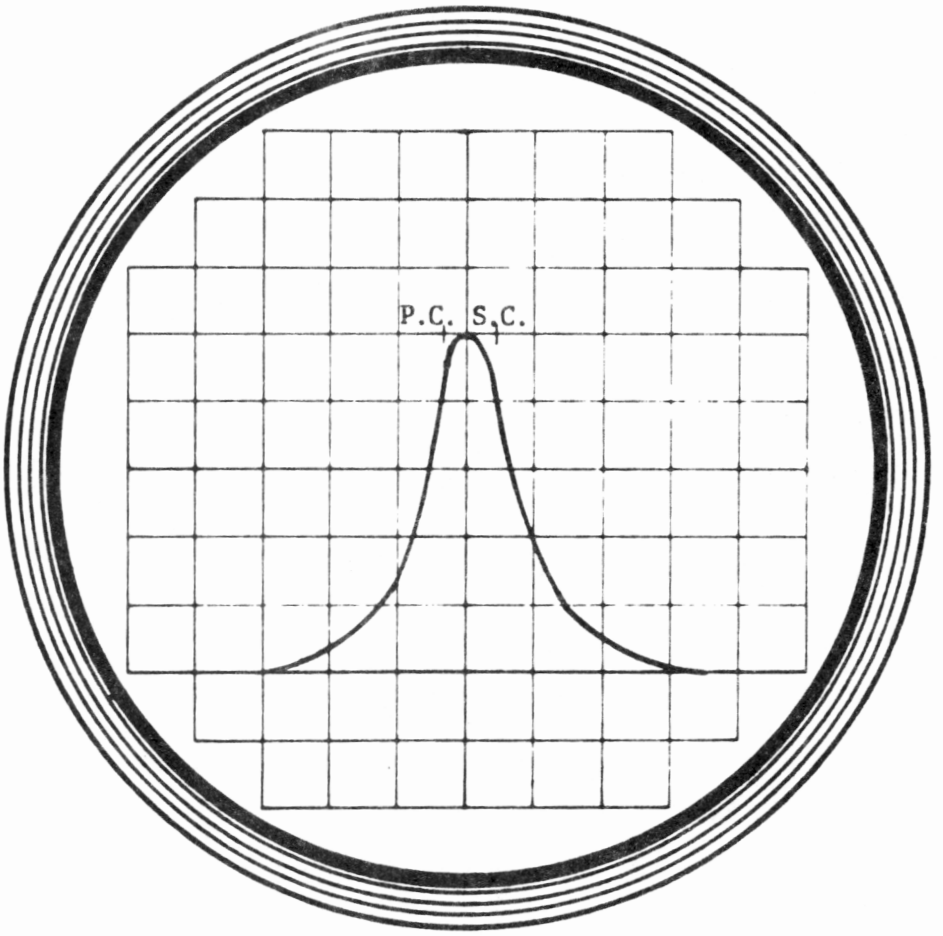
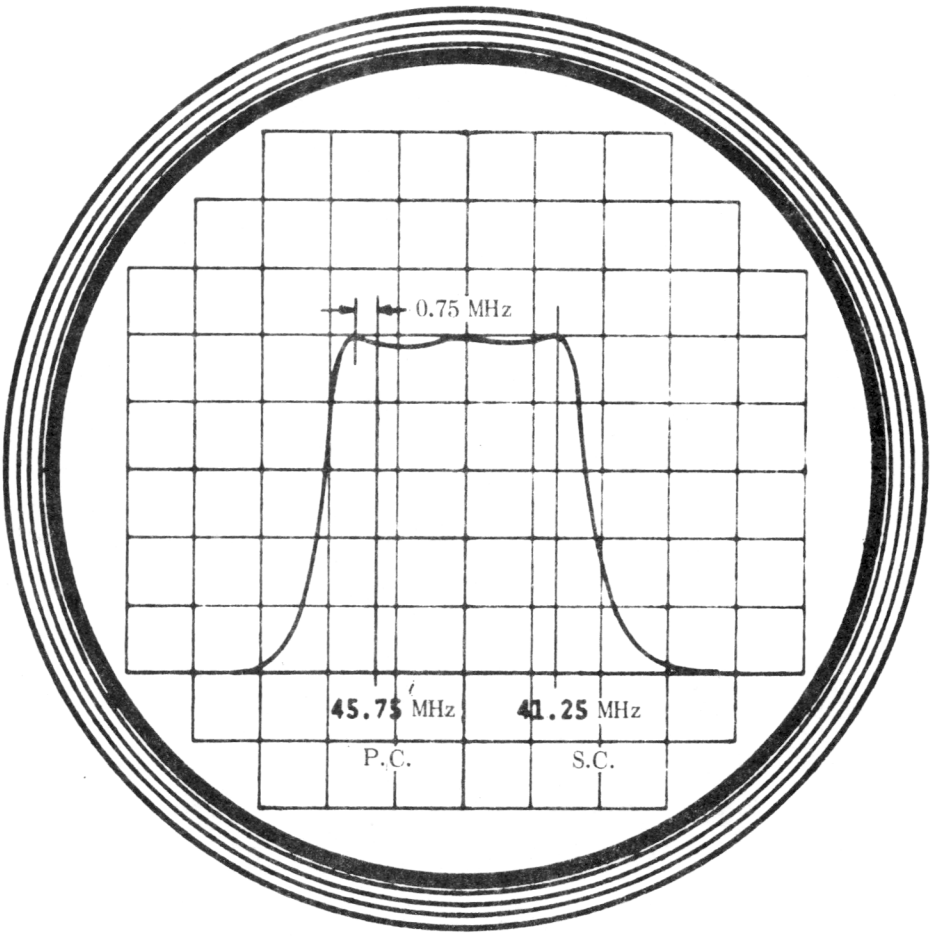


Fig. 5.15. Typical Output Response, Output Converter



Note: Response must remain flat 0.75 MHz beyond picture carrier.

Fig. 5.16. Typical Bandpass Response, Output Converter

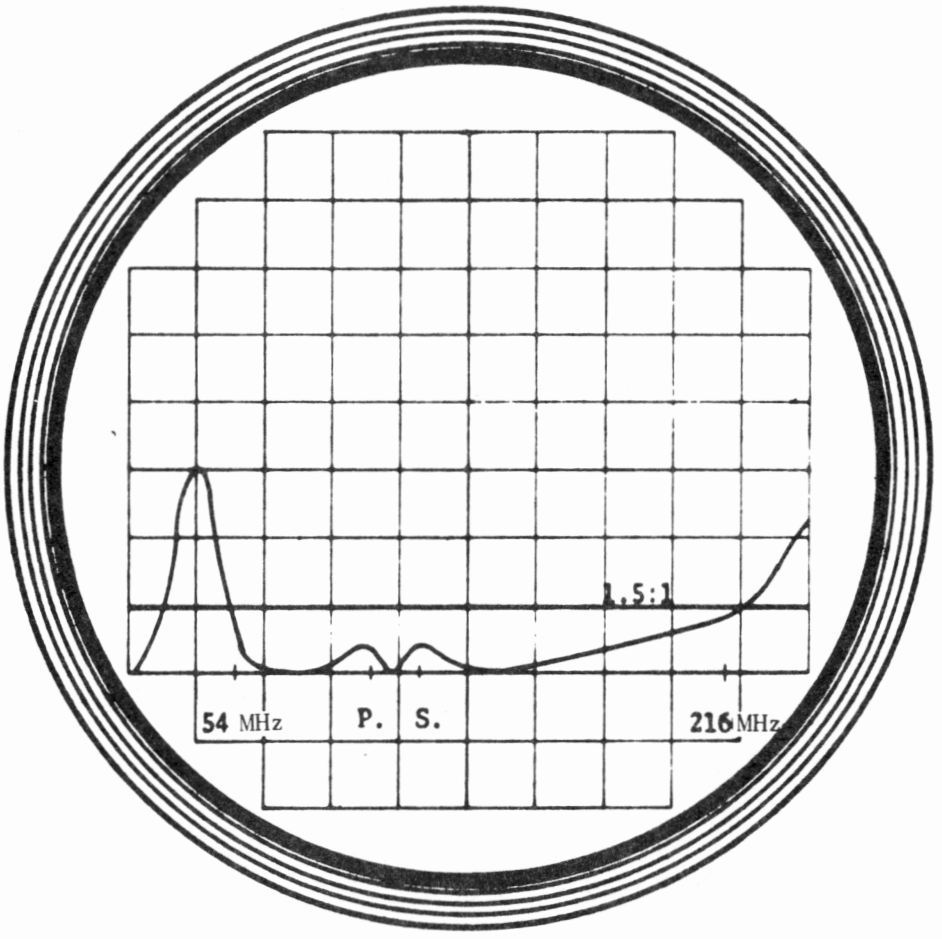


Fig. 5.17. Output VSWR Display, Output Converter

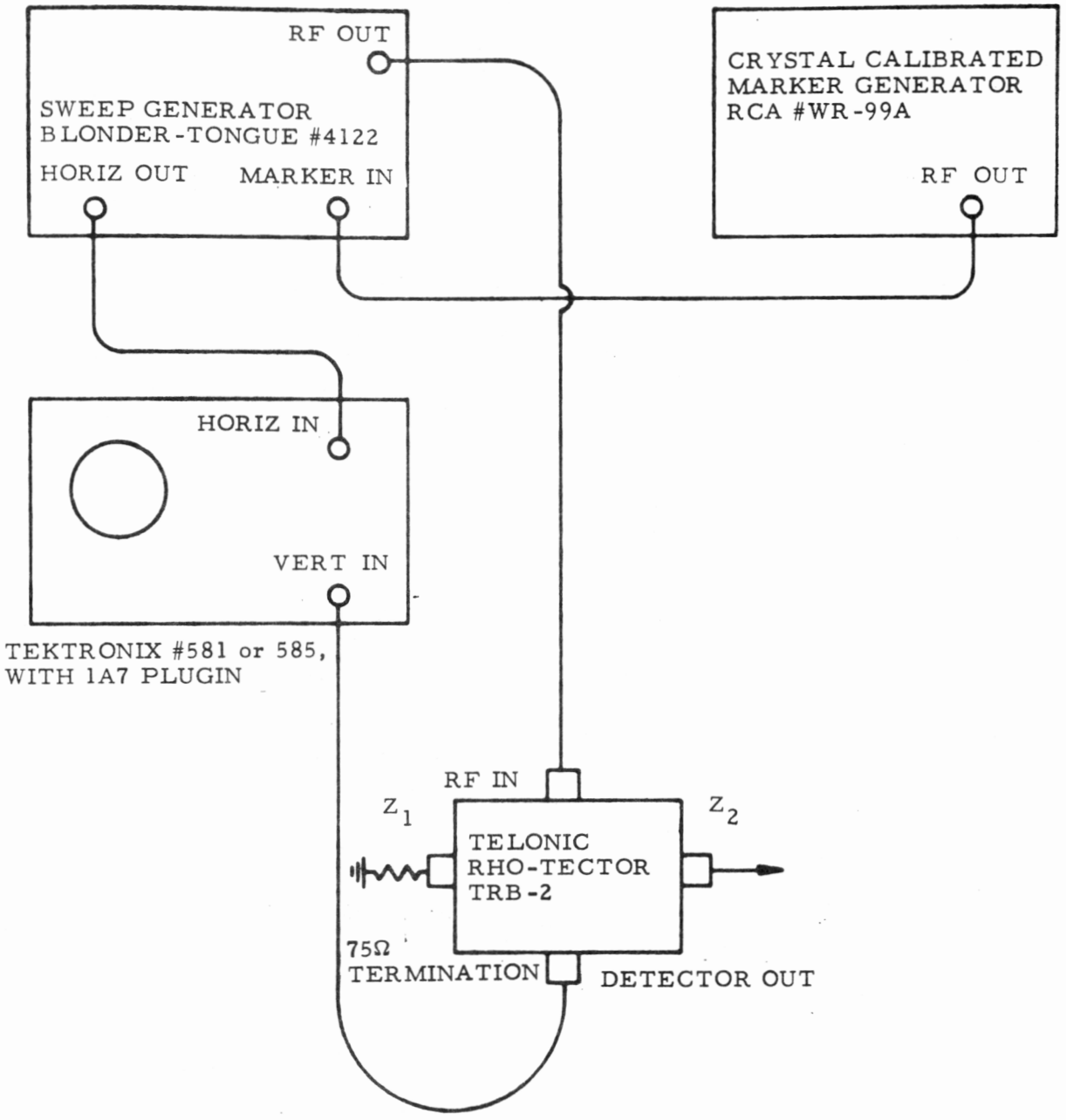


Fig. 5.18. Equipment Block Diagram for VSWR Measurements

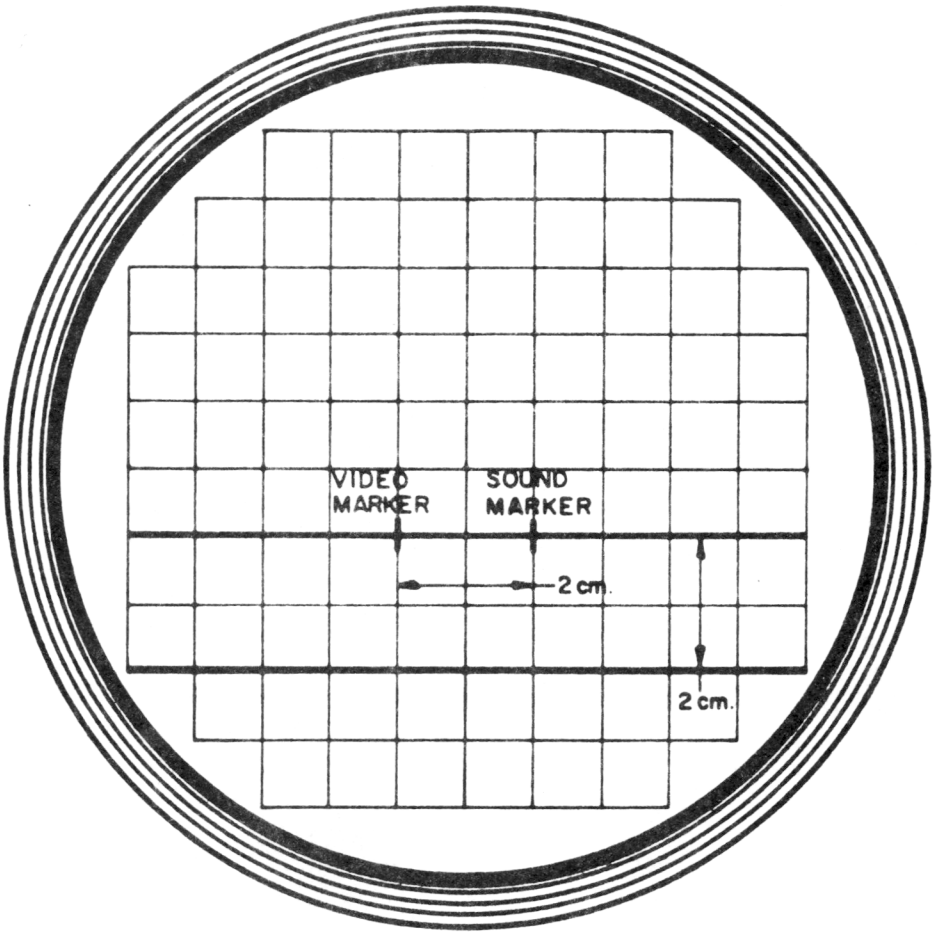


Fig. 5.19. VSWR Calibration Display (1.5:1 VSWR)

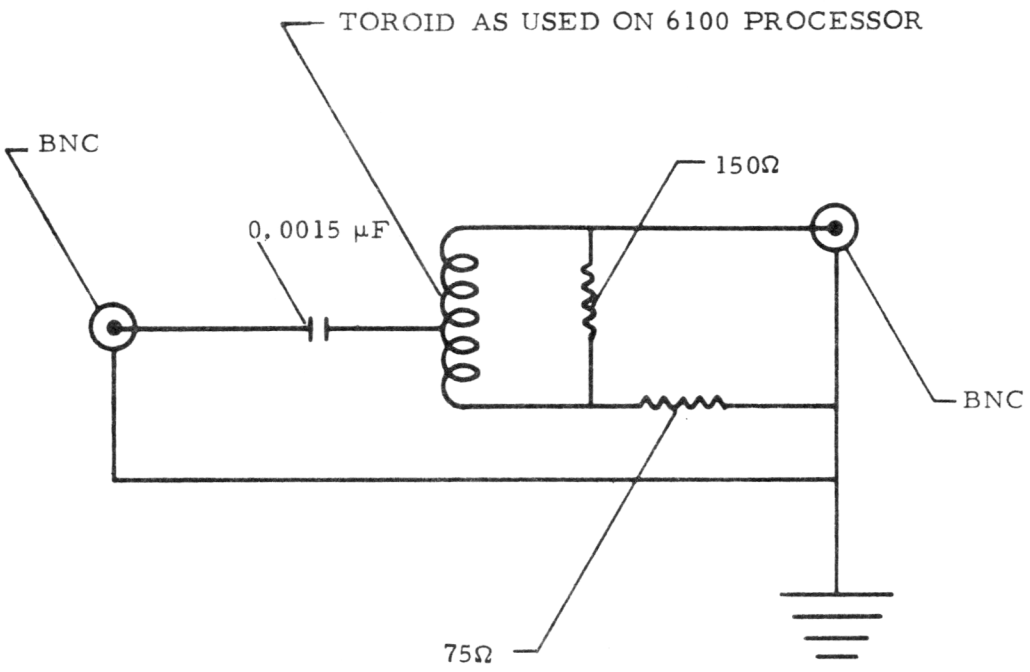


Fig. 5.20. Impedance Matching Schematic Diagram

CHAPTER 6
SCHEMATIC DIAGRAMS

The schematic diagrams for the Series 6100 CATV Receiver are presented in this section. Figure 6.1 is the overall unit schematic, and the figures following are the diagrams for the unit subassemblies, arranged in the order of their reference designations on Figure 6.1.

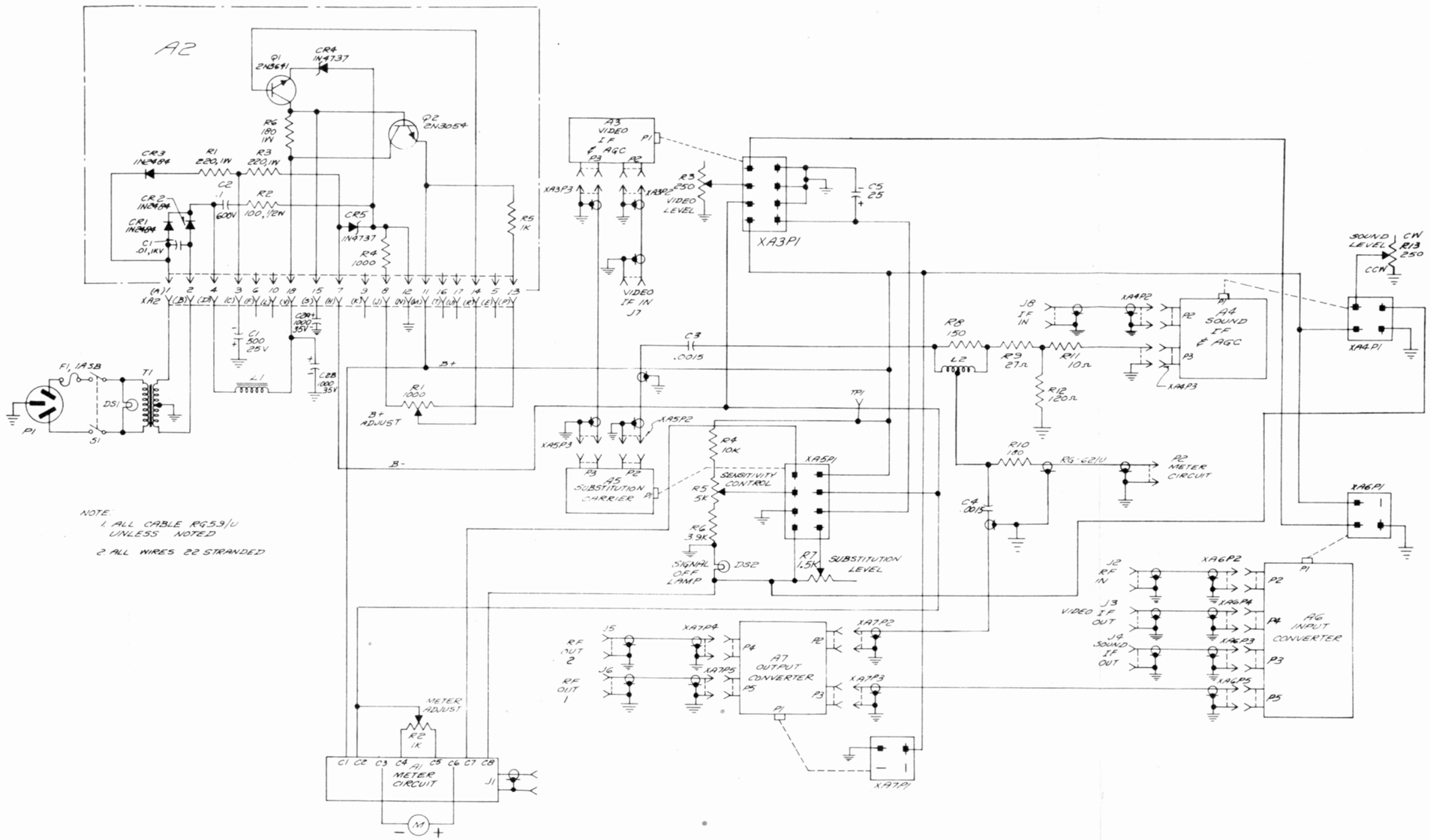


Figure 6.1. Series 6100 CATV Receiver, Schematic Diagram

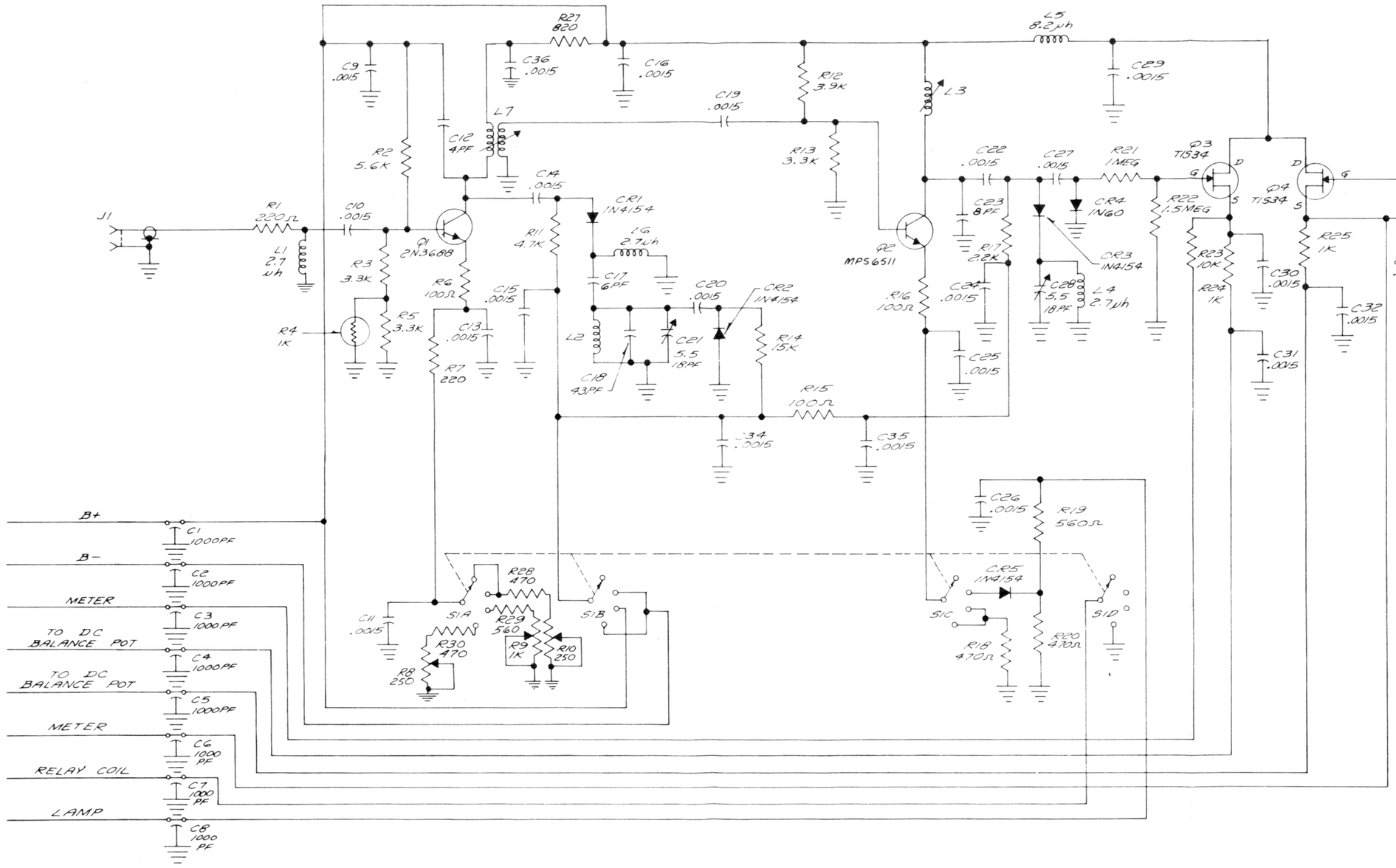


Figure 6.2. Meter Circuit Receiver, Schematic Diagram

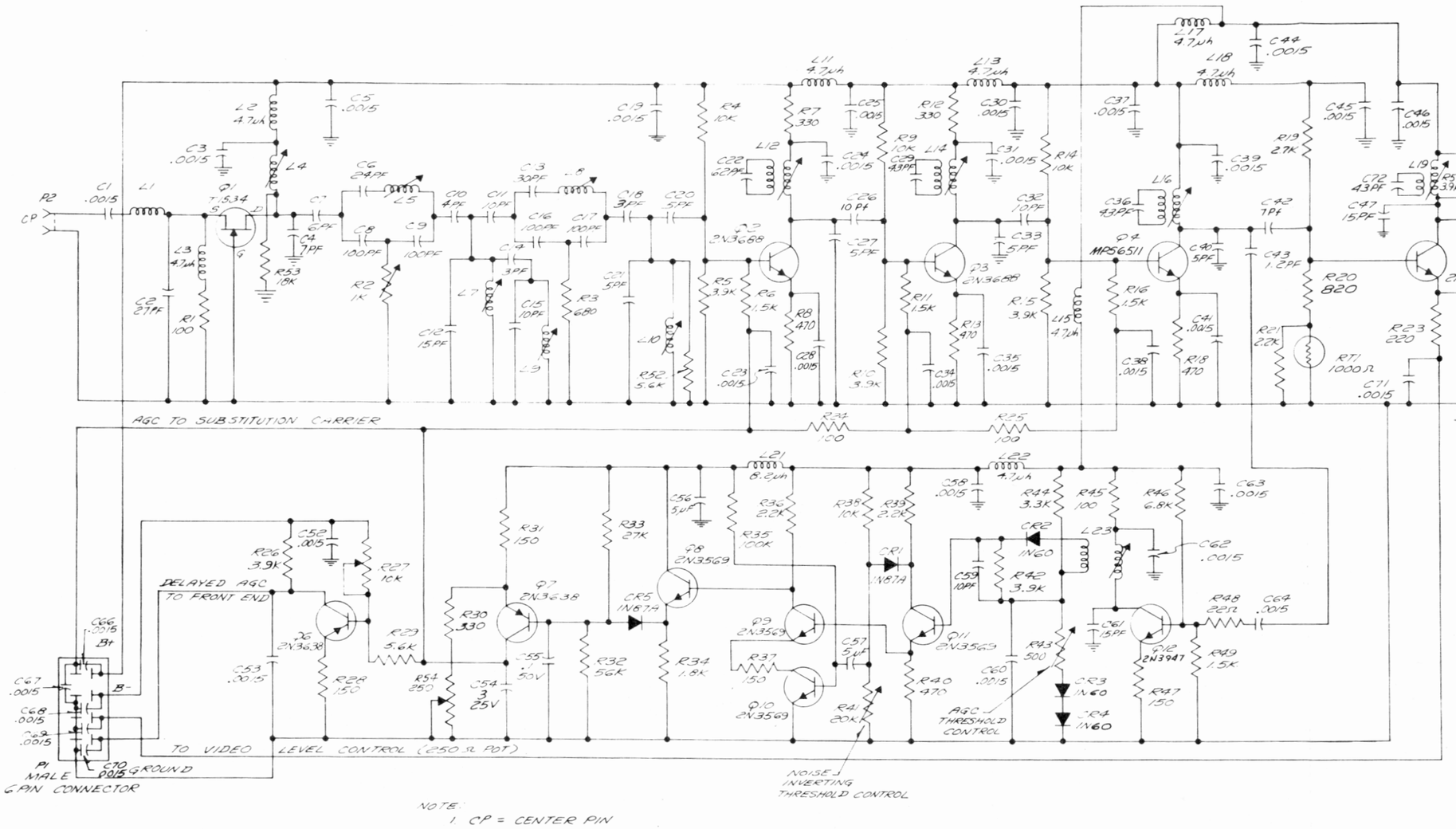
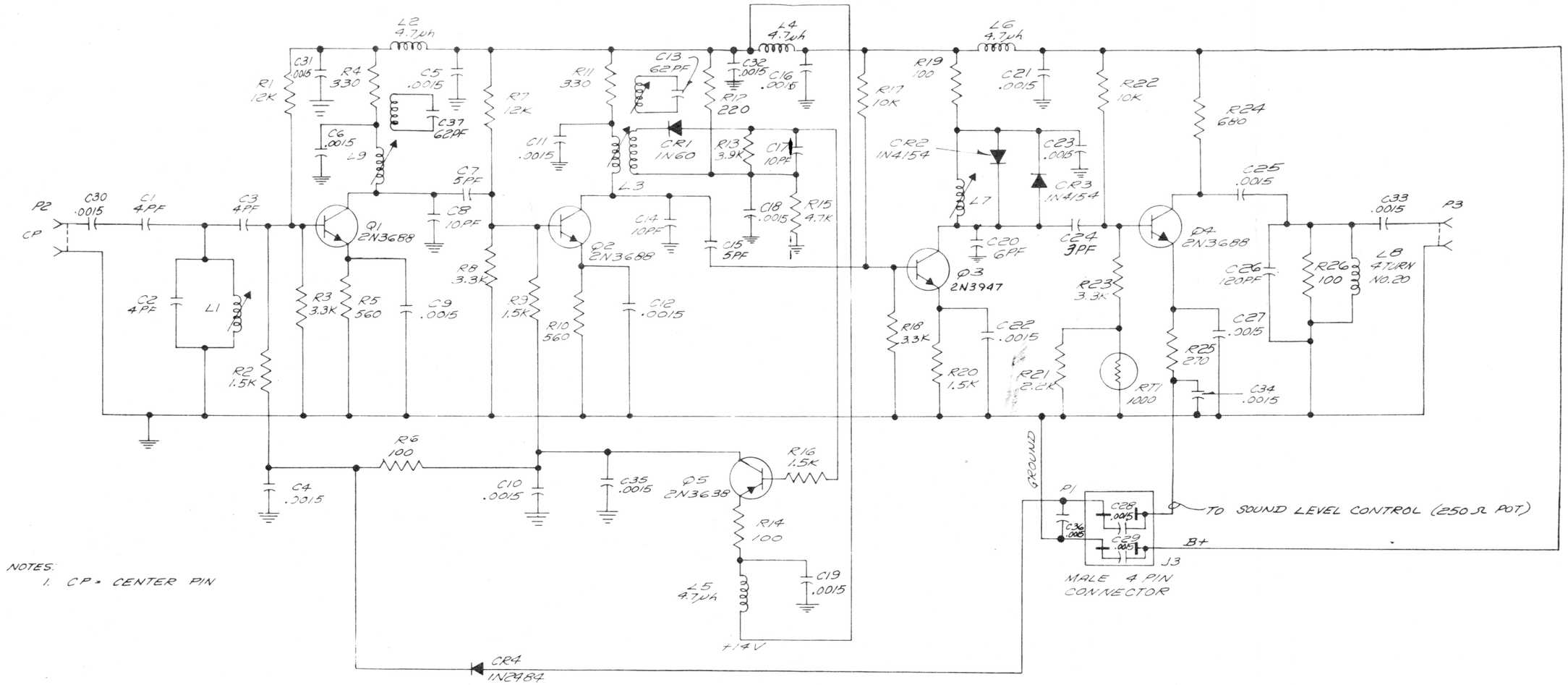
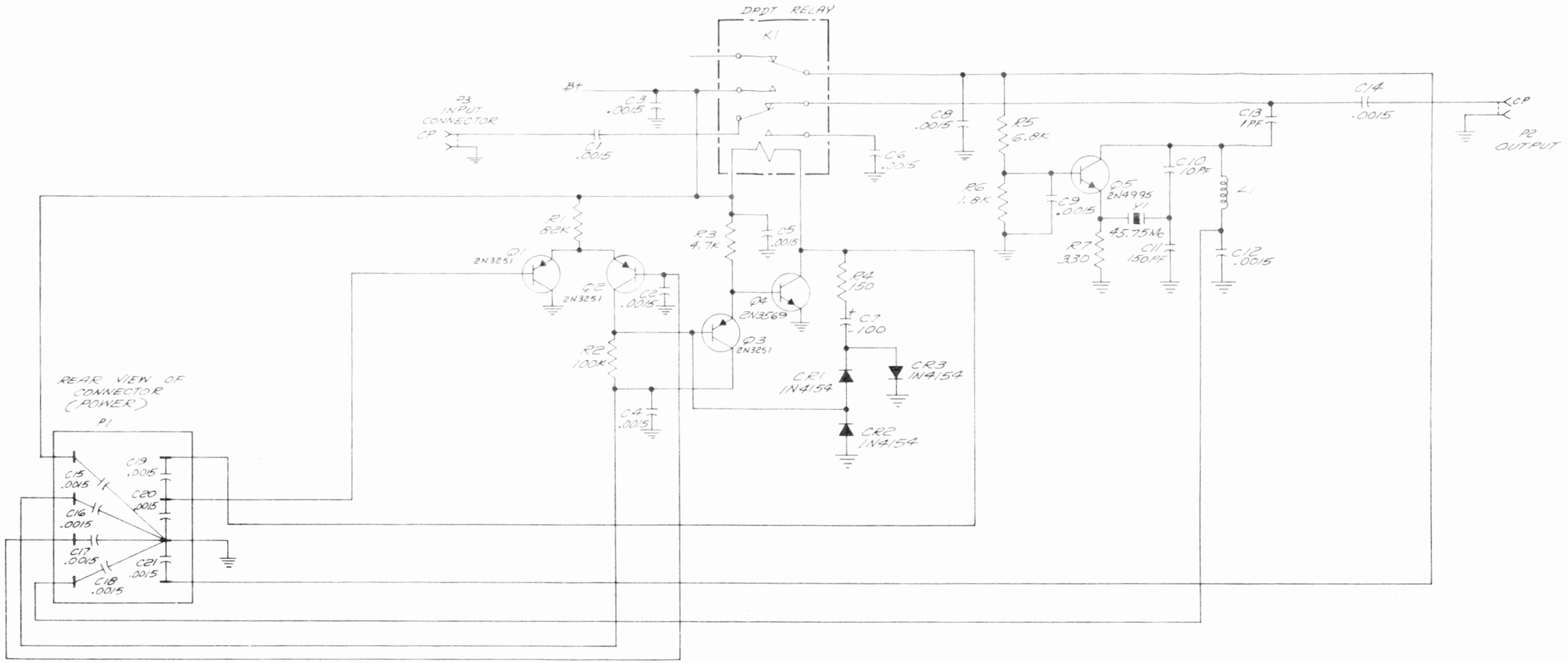


Figure 6.3. Video IF and AGC, Schematic Diagram



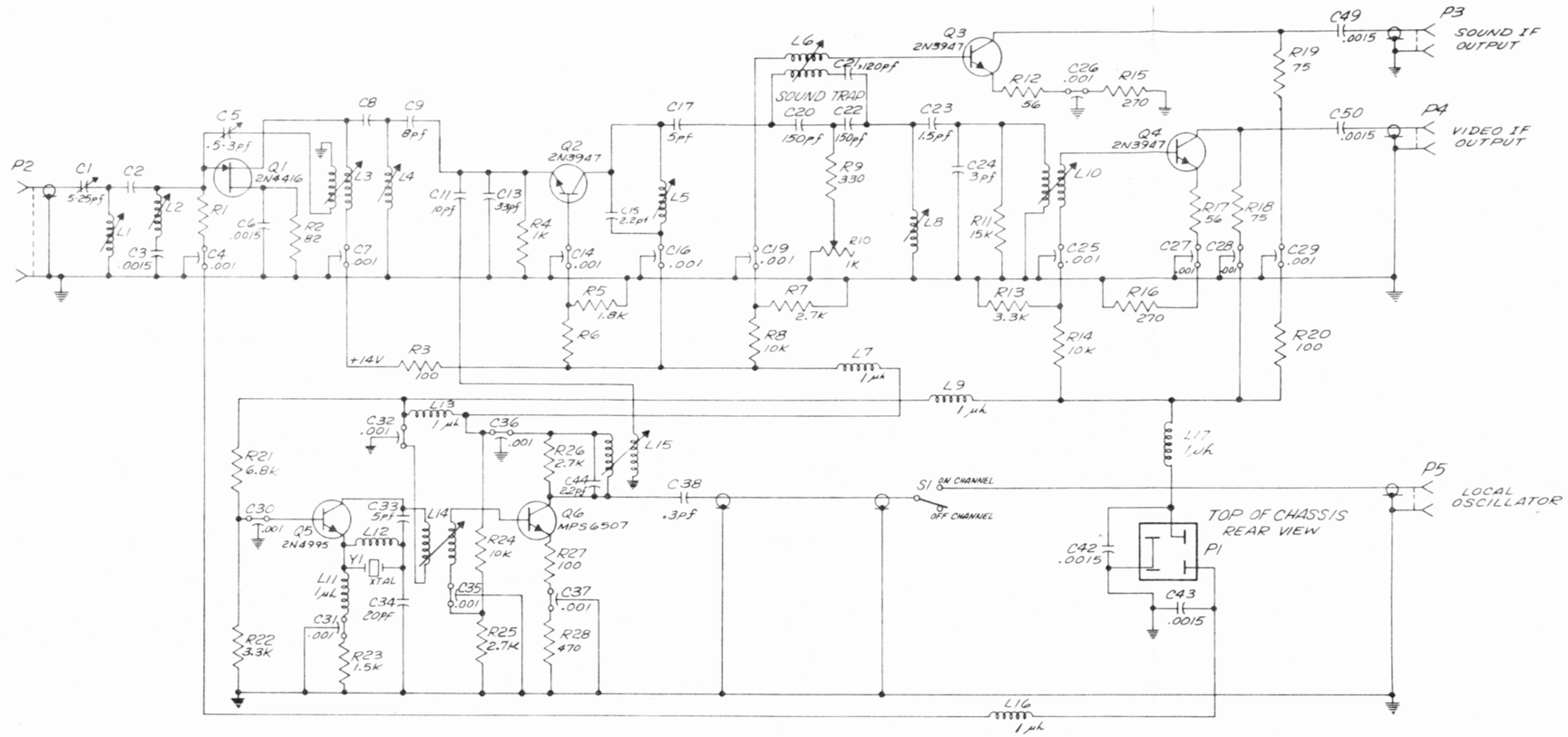
NOTES:
1. CP = CENTER PIN

Figure 6.4. Sound IF and AGC, Schematic Diagram



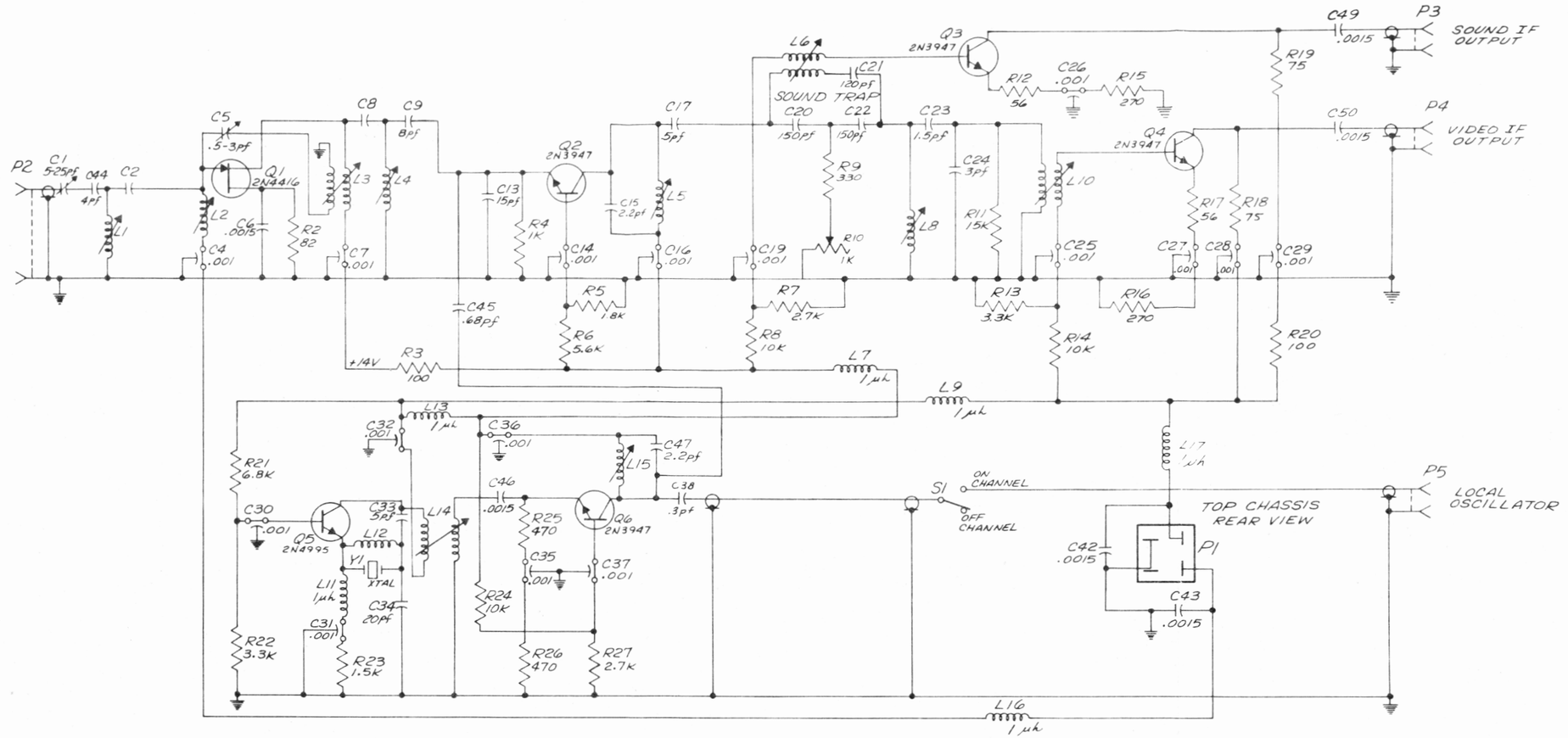
NOTE
1 CP = CENTER PIN

Figure 6.5. Substitution Carrier and Time Delay Circuit, Schematic Diagram



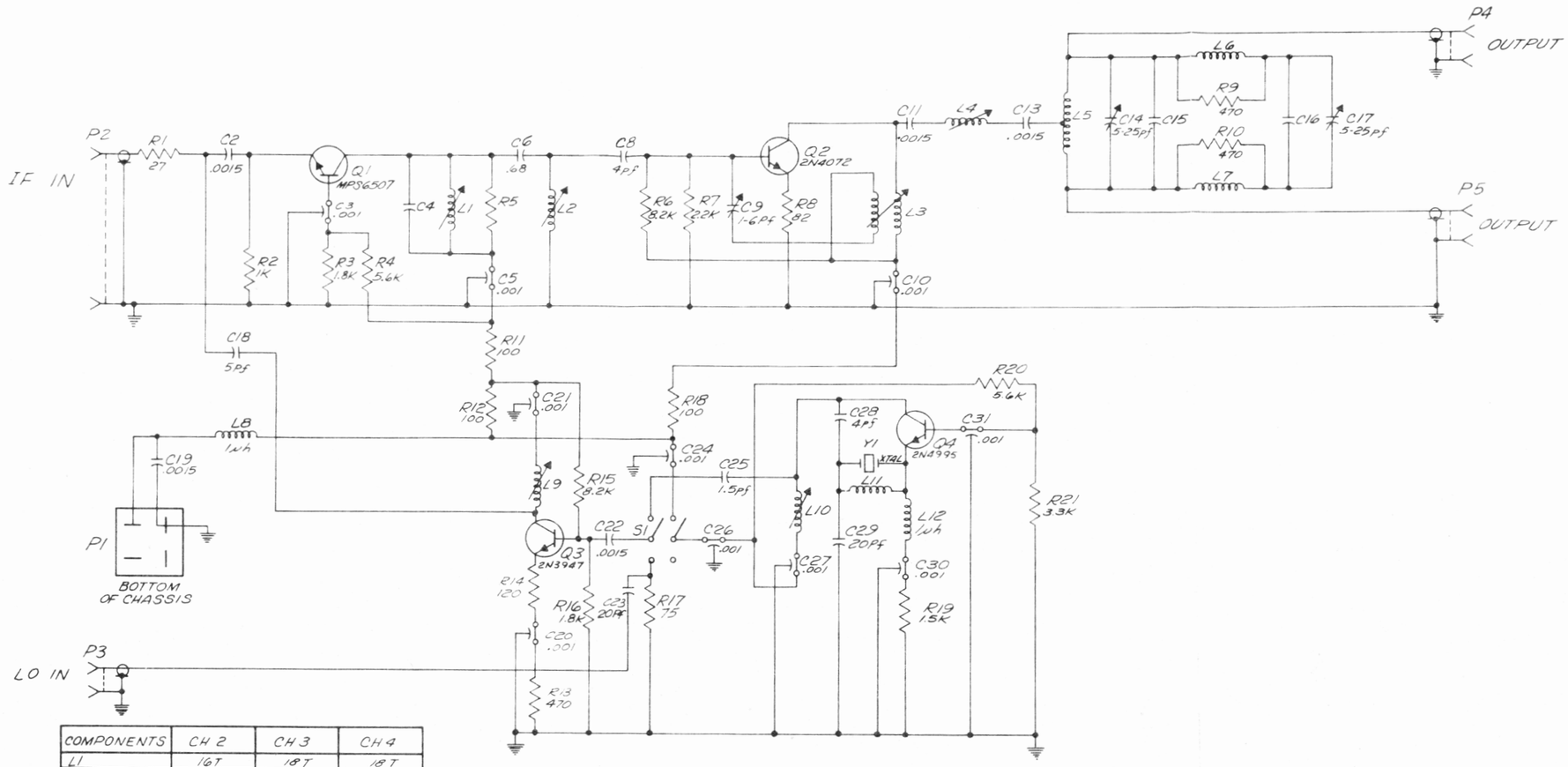
COMPONENTS	CH 2	CH 3	CH 4	CH 5	CH 6		
Y1 XTAL	101 MC	107 MC	113 MC	123 MC	129 MC		
L1	11T	8T	8T	7T	7T		
L2	11T	8T	8T	7T	7T		
L3	10T & 4T	8T & 3T	8T & 3T	7T & 3T	7T & 3T		
L4	10T	9T	8T	8T	7T		
C2	1.5pf	1pf	1.5pf	1.2pf	1.0pf		
C8	2.0pf	3pf	1.2pf	1pf	1.5pf		
R1	1.8K	3.9K	3.3K	3.3K	4.7K		
R6	5.6K	5.6K	5.6K	5.6K	1.8K		

Figure 6.6.1 VHF Input Converter, Schematic Diagram (Channels 2 to 6)



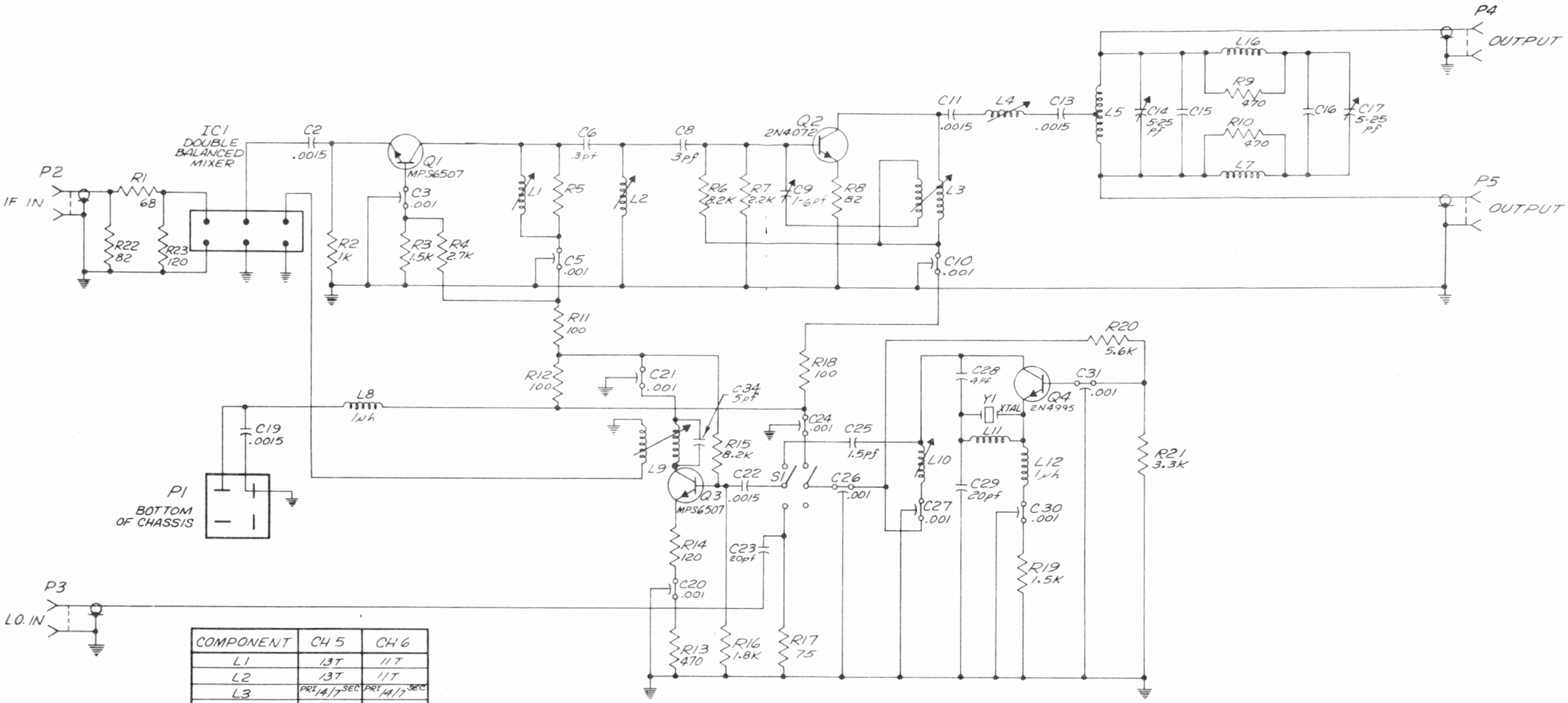
COMPONENTS	CH 7	CH 8	CH 9	CH 10	CH 11	CH 12	CH 13
Y1 XTAL MC	110.5	113.5	116.5	119.5	122.5	125.5	128.5
L1	4T	4T	4T	4T	4T	4T	4T
L2	3T	3T	3T	3T	3T	2T	2T
L3	PRI 4/2 SEC	PRI 4/2 SEC	PRI 4/2 SEC	PRI 4/2 SEC	PRI 4/2 SEC	PRI 4/2 SEC	PRI 4/2 SEC
L4	4T	4T	4T	4T	4T	3T	3T
C2	.75pf	.75pf	.75pf	.68pf	.75pf	.68pf	.75pf
C8	.75pf	.68pf	.75pf	1pf	1pf	1pf	1pf

Figure 6.6.2 VHF Input Converter, Schematic Diagram (Channels 7 to 13)



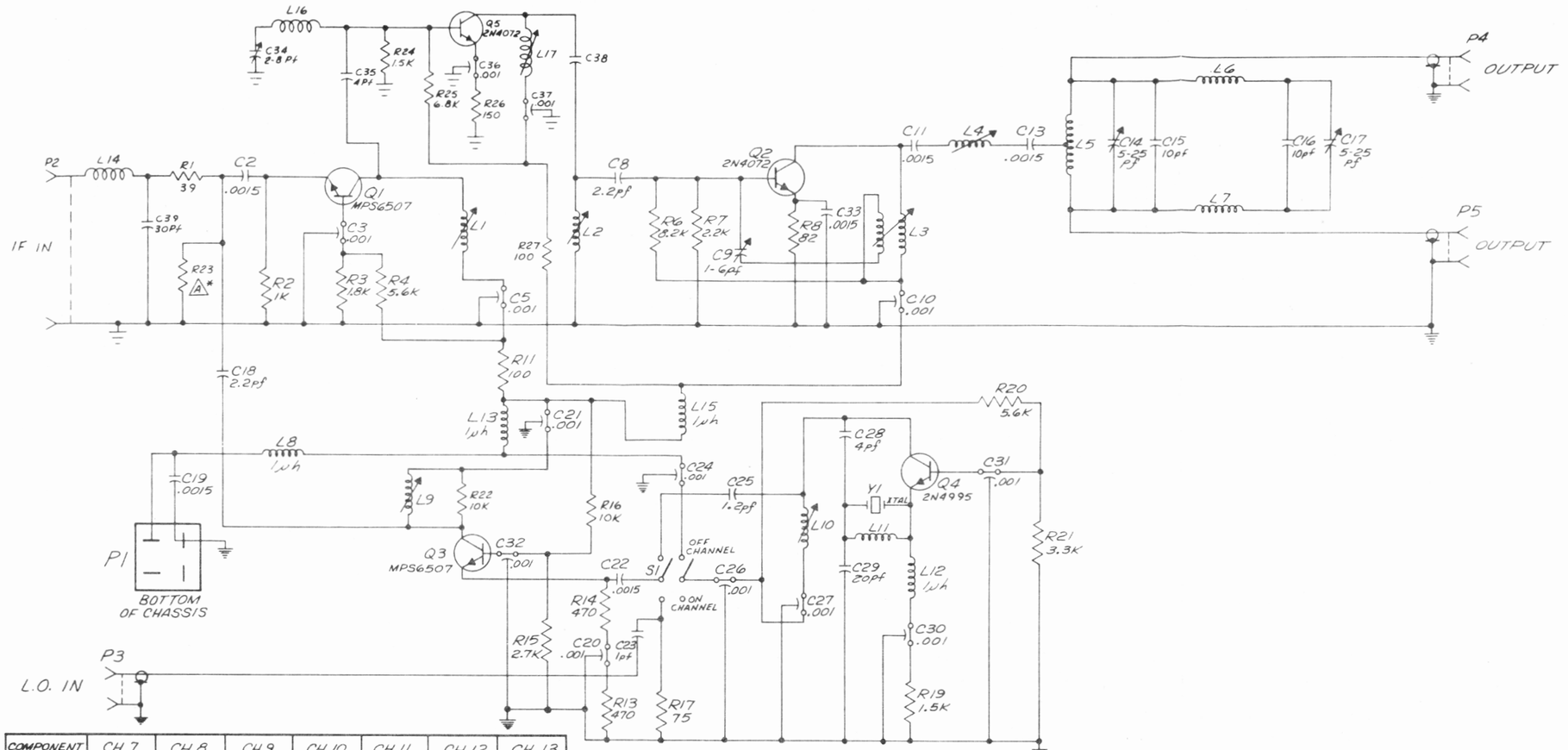
COMPONENTS	CH 2	CH 3	CH 4
L1	16T	18T	18T
L2	16T	18T	18T
L3	PRI 18/9 SEC	PRI 17/8 SEC	PRI 17/8 SEC
L4	8T	8T	7T
L9	6T	5T	5T
L10	6T	5T	5T
C4	2.2		
C6	.68	.68	.68
C15	82 PF	56 PF	43 PF
C16	180 PF	180 PF	180 PF
R5	10K	10K	10K
C18	5 PF	5 PF	5 PF
Y1 XTAL	101	107	113

Figure 6.7.1. VHF Output Converter, Schematic Diagram (Channels 2,3,and 4)



COMPONENT	CH 5	CH 6
L1	13T	11T
L2	13T	11T
L3	PRI 14/7 SEC	PRI 14/7 SEC
L4	7T	7T
L9	PRI 6/1 SEC	PRI 6/1 SEC
L10	5T	5T
C15	47pf	30pf
C16	82pf	62pf
Y1 XTAL	123	129
R5	8.2K	6.8K

Figure 6.7.2. VHF Output Converter, Schematic Diagram (Channels 5 and 6)



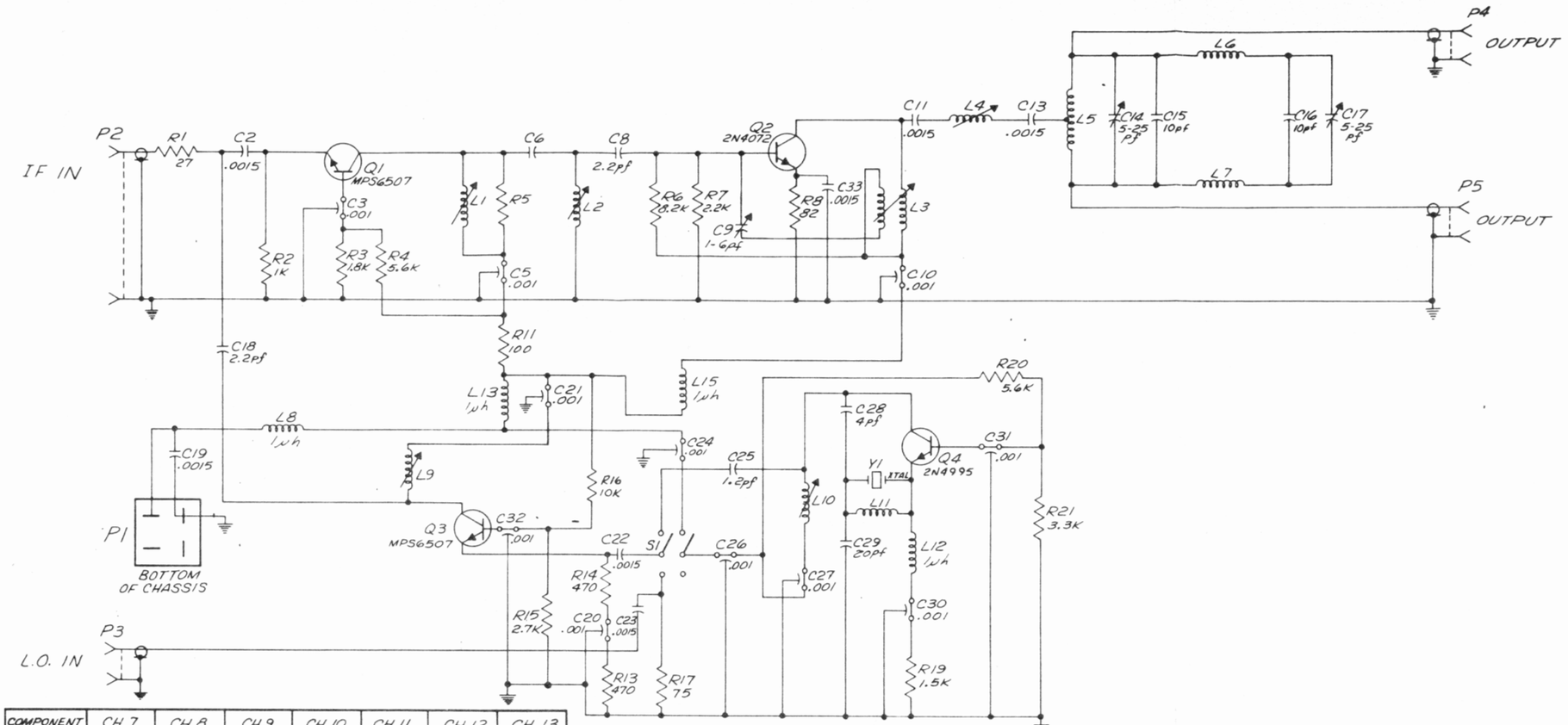
COMPONENT	CH 7	CH 8	CH 9	CH 10	CH 11	CH 12	CH 13
L1	4T	4T	4T	4T	4T	4T	3T
L2	4T	4T	4T	4T	4T	4T	3T
L3	PRI 6/3 SEC	PRI 6/3 SEC	PRI 6/3 SEC	PRI 6/3 SEC	PRI 5/2 SEC	PRI 4/2 SEC	PRI 4/2 SEC
L4	6T	6T	6T	5T	4T	3T	3T
L9	3T	3T	3T	3T	3T	3T	3T
L10	6T	6T	6T	6T	6T	6T	6T
L17	3T	3T	3T	3T	3T	3T	3T
L6 & L7	1T #24 3/16 I.D.						
C38	1.5pf	1.5pf	1.5pf	1.2pf	1.2pf	1pf	1pf
Y1 XTAL	110.5	113.5	116.5	119.5	122.5	125.5	128.5
L11	20T #24 3/16 I.D. CLOSE WOUND						

* SELECTED

△ TYPICAL VALUE IS OHM.

1-THIS DRAWING SUPERCEDES D61209.

Figure 6.7.3. VHF Output Converter, Schematic Diagram (Channels 7 to 13)



COMPONENT	CH 7	CH 8	CH 9	CH 10	CH 11	CH 12	CH 13
L1	6T	6T	6T	6T	5T	5T	5T
L2	6T	6T	6T	6T	6T	6T	6T
L3	PRI 6/3 SEC	PRI 6/3 SEC	PRI 6/3 SEC	PRI 6/3 SEC	PRI 5/2 SEC	PRI 4/2 SEC	PRI 4/2 SEC
L4	6T	6T	6T	5T	4T	3T	3T
L9	3T	3T	3T	3T	3T	3T	3T
L10	6T	6T	6T	6T	6T	6T	6T
C6	TWIN LEAD	TWIN LEAD	TWIN LEAD	TWIN LEAD	TWIN LEAD	TWIN LEAD	TWIN LEAD
L6 & L7	IT #24 3/16 I.D.						
Y1 XTAL	110.5	113.5	116.5	119.5	122.5	125.5	128.5
R5	4.7K	3.3K	3.9K	3.9K	4.7K	4.7K	4.7K
L11	20T #24 3/16 I.D. CLOSE WOUND						

Figure 6.8. Earlier Design of VHF Output Converter for Channels 7 to 13. In later units, transistor stage Q5 (see Figure 6.7.3) was added.

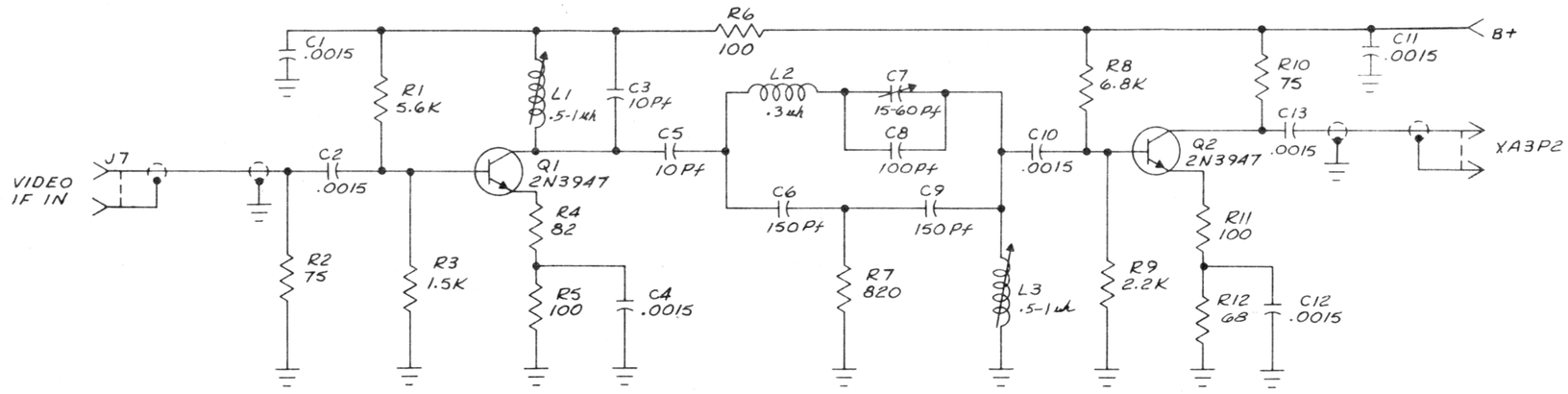


Figure 6.9. Second Sound Trap, Schematic Diagram

CONVERSION OF VOLTAGE AND POWER RATIOS TO DECIBELS

The basic chart below indicates the number of decibels (dB) corresponding to the listed ratios of voltage or power over the range of −20 to +20 dB. For voltage or power ratios greater than those included in the chart, the ratio can be broken down into a product of two numbers, the value in dB for each found separately, and the two results added. Example: To convert a power ratio of 2,000:1 to dB, express 2,000 as 2×10^3; the number of dB corresponding to a power ratio of 2 is very nearly 3, and the number of dB for a power ratio of 10^3 is 30. Therefore, the power ratio of 2,000:1 is approximately 30 dB + 3 dB = 33 dB. In the lower righthand corner of the chart dB values for voltage and power ratios of integral powers of 10 are given.

Voltage Ratio	*Power Ratio*	*−dB+*	*Voltage Ratio*	*Power Ratio*	*Voltage Ratio*	*Power Ratio*	*−dB+*	*Voltage Ratio*	*Power Ratio*	*Voltage Ratio*	*Power Ratio*	*−dB+*	*Voltage Ratio*	*Power Ratio*
1.000	**1.000**	**0**	**1.000**	**1.000**	**.447**	**.200**	**7.0**	**2.239**	**5.012**	**.200**	**.0398**	**14.0**	**5.012**	**25.12**
.989	.977	.1	1.012	1.023	.442	.195	7.1	2.265	5.129	.197	.0389	14.1	5.070	25.70
.977	.955	.2	1.023	1.047	.437	.191	7.2	2.291	5.248	.195	.0380	14.2	5.129	26.30
.966	.933	.3	1.035	1.072	.432	.186	7.3	2.317	5.370	.193	.0372	14.3	5.188	26.92
.955	.912	.4	1.047	1.096	.427	.182	7.4	2.344	5.495	.191	.0363	14.4	5.248	27.54
.944	.891	.5	1.059	1.122	.422	.178	7.5	2.371	5.623	.188	.0355	14.5	5.309	28.18
.933	.871	.6	1.072	1.148	.417	.174	7.6	2.399	5.754	.186	.0347	14.6	5.370	28.84
.923	.851	.7	1.084	1.175	.412	.170	7.7	2.427	5.888	.184	.0339	14.7	5.433	29.51
.912	.832	.8	1.096	1.202	.407	.166	7.8	2.455	6.026	.182	.0331	14.8	5.495	30.20
.902	.813	.9	1.109	1.230	.403	.162	7.9	2.483	6.166	.180	.0324	14.9	5.559	30.90
.891	**.794**	**1.0**	**1.122**	**1.259**	**.398**	**.159**	**8.0**	**2.512**	**6.310**	**.178**	**.0316**	**15.0**	**5.623**	**31.62**
.881	.776	1.1	1.135	1.288	.394	.155	8.1	2.541	6.457	.176	.0309	15.1	5.689	32.36
.871	.759	1.2	1.148	1.318	.389	.151	8.2	2.570	6.607	.174	.0302	15.2	5.754	33.11
.861	.741	1.3	1.161	1.349	.385	.148	8.3	2.600	6.761	.172	.0295	15.3	5,821	33.88
.851	.724	1.4	1.175	1.380	.380	.145	8.4	2.630	6.918	.170	.0288	15.4	5.888	34.67
.841	.708	1.5	1.189	1.413	.376	.141	8.5	2.661	7.079	.168	.0282	15.5	5.957	35.48
.832	.692	1.6	1.202	1.445	.372	.138	8,6	2.692	7.244	.166	.0275	15.6	6.026	36.31
.822	.676	1.7	1.216	1.479	.367	.135	8.7	2.723	7.413	.164	.0269	15.7	6.095	37.15
.813	.661	1.8	1.230	1.514	.363	.132	8.8	2.754	7.586	.162	.0263	15.8	6.166	38.02
.804	.646	1.9	1.245	1.549	.359	.129	8.9	2.786	7.762	.160	.0257	15.9	6.237	38.90
.794	**.631**	**2.0**	**1.259**	**1.585**	**.355**	**.126**	**9.0**	**2.818**	**7.943**	**.159**	**.0251**	**16.0**	**6.310**	**39.81**
.785	.617	2.1	1.274	1.622	.351	.123	9.1	2.851	8.128	.157	.0246	16.1	6.383	40.74
.776	.603	2.2	1.288	1.660	.347	.120	9.2	2.884	8.318	.155	.0240	16.2	6.457	41.69
.767	.589	2.3	1.303	1.698	.343	.118	9.3	2.917	8.511	.153	.0234	16.3	6.531	42.66
.759	.575	2.4	1.318	1.738	.339	.115	9.4	2.951	8.710	.151	.0229	16.4	6.607	43.65
.750	.562	2.5	1.334	1.778	.335	.112	9.5	2.985	8.913	.150	.0224	16.5	6.683	44.67
.741	.550	2.6	1.349	1.820	.331	.110	9.6	3.020	9.120	.148	.0219	16.6	6.761	45.71
.733	.537	2.7	1.365	1.862	.327	.107	9.7	3.055	9.333	.146	.0214	16.7	6.839	46.77
.724	.525	2.8	1.380	1.905	.324	.105	9.8	3.090	9.550	.145	.0209	16.8	6.918	47.86
.716	.513	2.9	1.396	1.950	.320	.102	9.9	3.126	9.772	.143	.0204	16.9	6.998	48.98
.708	**.501**	**3.0**	**1.413**	**1.995**	**.316**	**.100**	**10.0**	**3.162**	**10.000**	**.141**	**.0200**	**17.0**	**7.079**	**50.12**
.700	.490	3.1	1.429	2.042	.313	.0977	10.1	3.199	10.23	.140	.0195	17.1	7.161	51.29
.692	.479	3.2	1.445	2.089	.309	.0955	10.2	3.236	10.47	.138	.0191	17.2	7.244	52.48
.684	.468	3.3	1.462	2.138	.306	.0933	10.3	3.273	10.72	.137	.0186	17.3	7.328	53.70
.676	.457	3.4	1.479	2.188	.302	.0912	10.4	3.311	10.96	.135	.0182	17.4	7.413	54.95
.668	.447	3.5	1.496	2.239	.299	.0891	10.5	3.350	11.22	.133	.0178	17.5	7.499	56.23
.661	.437	3.6	1.514	2.291	.295	.0871	10.6	3.388	11.48	.132	.0174	17.6	7.586	57.54
.653	.427	3.7	1.531	2.344	.292	.0851	10.7	3.428	11.75	.130	.0170	17.7	7.674	58.88
.646	.417	3.8	1.549	2.399	.288	.0832	10.8	3.467	12.02	.129	.0166	17.8	7.762	60.26
.638	.407	3.9	1.567	2.455	.285	.0813	10.9	3.508	12.30	.127	.0162	17.9	7.852	61.66
.631	**.398**	**4.0**	**1.585**	**2.512**	**.282**	**.0794**	**11.0**	**3.548**	**12.59**	**.126**	**.0159**	**18.0**	**7.943**	**63.10**
.624	.389	4.1	1.603	2.570	.279	.0776	11.1	3.589	12.88	.125	.0155	18.1	8.035	64.57
.617	.380	4.2	1.622	2.630	.275	.0759	11.2	3.631	13.18	.123	.0151	18.2	8.128	66.07
.610	.372	4.3	1.641	2.692	.272	.0741	11.3	3.673	13.49	.122	.0148	18.3	8.222	67.61
.603	.363	4.4	1.660	2.754	.269	.0724	11.4	3.715	13.80	.120	.0145	18.4	8.318	69.18
.596	.355	4.5	1.679	2.818	.266	.0708	11.5	3.758	14.13	.119	.0141	18.5	8.414	70.79
.589	.347	4.6	1.698	2.884	.263	.0692	11.6	3.802	14.45	.118	.0138	18.6	8.511	72.44
.582	.339	4.7	1.718	2.951	.260	.0676	11.7	3.846	14.79	.116	.0135	18.7	8.610	74.13
.575	.331	4.8	1.738	3.020	.257	.0661	11.8	3.890	15.14	.115	.0132	18.8	8.710	75.86
.569	.324	4.9	1.758	3.090	.254	.0646	11.9	3.936	15.49	.114	.0129	18.9	8.811	77.62
.562	**.316**	**5.0**	**1.778**	**3.162**	**.251**	**.0631**	**12.0**	**3.981**	**15.85**	**.112**	**.0126**	**19.0**	**8.913**	**79.43**
.556	.309	5.1	1.799	3.236	.248	.0617	12.1	4.027	16.22	.111	.0123	19.1	9.016	81.28
.550	.302	5.2	1.820	3.311	.246	.0603	12.2	4.074	16.60	.110	.0120	19.2	9.120	83.18
.543	.295	5.3	1.841	3.388	.243	.0589	12.3	4.121	16.98	.108	.0118	19.3	9.226	85.11
.537	.288	5.4	1.862	3.467	.240	.0575	12.4	4.169	17.38	.107	.0115	19.4	9.333	87.10
.531	.282	5.5	1.884	3.548	.237	.0562	12.5	4.217	17.78	.106	.0112	19.5	9.441	89.13
.525	.275	5.6	1.905	3.631	.234	.0550	12.6	4.266	18.20	.105	.0110	19.6	9.550	91.20
.519	.269	5.7	1.928	3.715	.232	.0537	12.7	4.315	18.62	.104	.0107	19.7	9.661	93.33
.513	.263	5.8	1.950	3.802	.229	.0525	12.8	4.365	19.05	.102	.0105	19.8	9.772	95.50
.507	.257	5.9	1.972	3.890	.227	.0513	12.9	4.416	19.50	.101	.0102	19.9	9.886	97.72
.501	**.251**	**6.0**	**1.995**	**3.981**	**.224**	**.0501**	**13.0**	**4.467**	**19.95**	**.100**	**.0100**	**20.0**	**10.000**	**100.00**
.496	.246	6.1	2.018	4.074	.221	.0490	13.1	4.519	20.42					
.490	.240	6.2	2.042	4.169	.219	.0479	13.2	4.571	20.89		10^{-3}	30		10^3
.484	.234	6.3	2.065	4.266	.216	.0468	13.3	4.624	21.38	10^{-2}	10^{-4}	40	10^2	10^4
.479	.229	6.4	2.089	4.365	.214	.0457	13.4	4.677	21.88					
											10^{-5}	50		10^5
.473	.224	6.5	2.113	4.467	.211	.0447	13.5	4.732	22.39	10^{-3}	10^{-6}	60	10^3	10^6
.468	.219	6.6	2.138	4.571	.209	.0437	13.6	4.786	22.91		10^{-7}	70		10^7
.462	.214	6.7	2.163	4.677	.207	.0427	13.7	4.842	23.44	10^{-4}	10^{-8}	80	10^4	10^8
.457	.209	6.8	2.188	4.786	.204	.0417	13.8	4.898	23.99		10^{-9}	90		10^9
.452	.204	6.9	2.213	4.898	.202	.0407	13.9	4.955	24.55					
										10^{-5}	10^{-10}	100	10^5	10^{10}
											10^{-11}	110		10^{11}
										10^{-6}	10^{-12}	120	10^6	10^{12}

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